APRIL 17, 1985 VOLUME 19, NUMBER 15A

COMPUTERWORLD FOCUS

GETTING DOWN TO BUSINESS WITH GRAPHICS

Contents

COMPUTERWORLD FOCUS

CW COMMUNICATIONS/INC.
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Framingham, Mass. 01701

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Second-class postage paid at Framingham, Mass., and additional mailing offices. *Computerworld* (ISSN-0010-4841) is published weekly, except: January (3 issues), February (3 issues), March (5 issues), April (4 issues), May (5 issues), June (5 issues), August (5 issues), September (4 issues), October (5 issues), November (3 issues), and a single combined issue the last week in December and the first week in January by CW Communications/Inc., Box 880, 375 Cochituate Road, Framingham, Mass. 01701.

Computerworld subscription prices: $2.00 a copy; U.S. — $44 a year; Canada, Central & So. America — $110 a year; Europe — $165 a year; all other countries — $245 a year (airmail service). *Computerworld Focus* prices: $5.00 a copy; $12.00 a year. Four weeks notice is required for change of address. Please allow six weeks for new subscription service to begin.

Computerworld can be purchased on 35mm microfilm through University Microfilm Inc., Periodical Entry Dept., 300 Zeeb Rd., Ann Arbor, Mich. 48106. *Computerworld* is indexed; write to Circulation Dept. for subscription information.

ABP

POSTMASTER: Send Form 3579 (Change of Address) to Computerworld Focus Circulation Dept., P.O. Box 1016, Southeastern, PA 19398-9984.

Computerworld Focus is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes over 50 computer publications in 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: [illegible]

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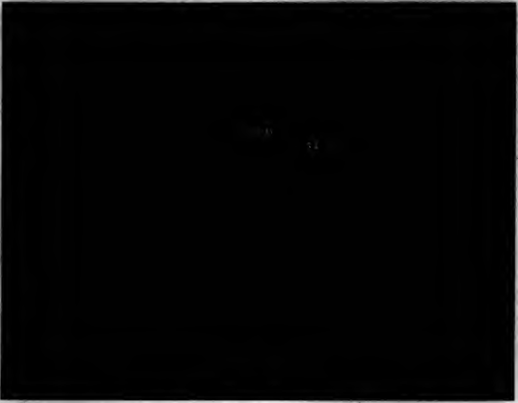

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Editorial

Not-So-Personal Computers

The day of the personal computer has come and gone. That's not to say that organizations will stop buying microcomputers in large numbers or that micro vendors should throw in the towel. It does mean that organizations across the country are finding out that the personal computer is not really so personal, after all. The dream of a computer on every white-collar worker's desktop may be just that — a dream. And a growing number of vendors are painfully waking up from that dream — some more abruptly than others.

Instead of opting for one-for-one purchases, organizations are utilizing micros as shared resources. A recent study by Future Computing, Inc. discovered that one quarter of the personal computers in use by businesses are shared by 10 or more users. The study showed that on the average, 2.3 people shared an office personal computer.

The micro, once considered so inexpensive it could be written off as a miscellaneous expense, has grown more costly as end users become more sophisticated and require more training, more memory, more peripherals and more software and support. In reality, the executive has not yet endorsed microcomputers by using them himself. Professionals don't need to use micros eight hours a day, and organizations have found it increasingly harder to cost-justify full-time access for every office worker.

Shared usage, departmental computing, more active use of minis as links between micros and mainframes all place less emphasis on micros as single-user tools and more emphasis on their role as part of a shared, integrated system. Recent announcements from the vendor community bear witness to this trend. This year has already proven to be one of the most eventful the industry has ever experienced. Not only are micro software vendors dropping off in record numbers, but traditional mini and mainframe vendors are suffering as well.

IBM's decision to drop the PCjr, although not unexpected, is a jolt to its reputation of being able to successfully pull in market share, almost regardless of product. The demise of the PCjr also raises grave doubts over the future of the home market; the machines are virtually being given away by retailers that have been left with large inventories. Declining growth rates, layoffs or temporary shutdowns have been reported by IBM, Data General Corp., Apple Computer, Inc., Digital Equipment Corp., Intel Corp. and even Wang Laboratories, Inc. Although a number of factors in the market conspired to produce these events, the evolution of the personal computer is also having its effect. And this time, the users seem to be calling the shots.

Insider

At Least 1,000 — Maybe More!

By Tom Willmott

Several years ago, during data processing's medieval period, I attended a product seminar held at the local sales office of a minicomputer vendor. This session was held to demonstrate new, super-mini-based software that automated engineering drafting and design applications. I was not well versed in the range and power of computer-aided graphics offerings, and I felt it was important to see a representative sample, 1980-style.

It was a straightforward drafting package, although undoubtedly quite crude by today's standards. The software vendor's marketing representative capably demonstrated how the program could be instructed to create lines and a variety of shapes from a draftsman's template. A previously completed file was brought to the screen after several rudimentary exercises were completed. The file presented an architectural rendering of a house — a New England-style, Royal Barry Wills cape, complete with massive chimney and multipane front windows. So far, so good. This was a useful, if relatively uncomplicated, piece of graphics program code.

Then, without warning, the woman at the terminal tapped one or two keys. In an instant the image on the CRT had zoomed in on the detail work around the front door, including a complete schematic of the front doorbell. I was completely unprepared for this turn of events. In fact, I was awestruck.

At that moment in time the full power and potential of computer graphics became clear to me.

In fact, computer graphics coupled with simulation and modeling software has been at the heart of the dramatic progress of integrated circuit design.

The graphics market divides rather neatly into the following four major segments:

- Low-end, personal computer-based — These are typically business graphics applications, notably Visicorp's Visiplot, BPS Information Services, Inc.'s Business Graphics, Lotus Development Corp.'s 1-2-3 and a variety of products running in the IBM PC environment. This generation of products works beautifully with multipen plotters, many of which sell for less than $2,000. We also include the innovative Macpaint software in this category. This program, coupled with the Apple Computer Inc. Macintosh's high-resolution screen and Apple's new laser printer, is clearly a giant leap for the market's low-cost end.
- High-end, personal computer-based — With a hardware upgrade of the generic personal computer, including high-resolution screen and expansion boards, it is possible now to achieve most of the two-dimensional drafting and simulation capability I described in that 1980 minicomputer offering. Clearly, IBM is targeting the engineering and design market as a major business opportunity. It would not be surprising to see enhanced PC ATs in 1985 as one way to meet the needs of this market segment.
- High-resolution, microprocessor-based terminals — These devices have been used as workstations attached to a host, shared-logic architecture since Tektronix, Inc. captured major market share with its terminals in the 1970s. Now companies (such as Ramtek Corp., Tektronix, Inc. and Lexidata Corp.) sell workstations, or companies (such as Computervision Corp., Applicon, Inc., Integraph Corp. and GE Calma) sell complete systems or companies (such as Prime Computer, Inc.) sell some combination of products through OEM and systems integrator arrangements (such as Prime's price performer, the 9955).
- High-resolution, microprocessor-based independent workstations — The fourth in the catalog of products describes the ability of the workstation to go it alone. Sun Microsystems, Inc. and Apollo Computer, Inc. come to mind immediately as independent workstation offerings with software sufficient for all but the most sophisticated of graphics applications.

It is, perhaps, at the workstation level where the most exciting developments continue. Refresh rates and memory-to-screen bus speeds boggle the imagination. The new terminals may offer megabytes of main memory. And the common instruction sets of a handful of popular microprocessor designs have led to a wealth of excellent software.

The future should hold continued price performance improvements, nearly unbelievable advances in the sophistication of the software environment and a broad impact on the ability of vendors in every industry that uses graphics equipment to bring new products more quickly and efficiently.

Willmott is vice-president of user research for International Data Corp. in Framingham, Mass., and a regular columnist for Computerworld Focus.

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Q&A

James R. Warner is president of Precision Visuals, Inc., a graphics software supplier headquartered in Boulder, Colo. After spending seven years at the University of Colorado as a teacher and applications developer, Warner joined with three university colleagues to form Precision Visuals in 1980. He shared with Computerworld Focus *some thoughts on what the management information systems (MIS) manager should look for in computer graphics.*

What's the first thing an MIS manager should ask of a graphics vendor?

The first thing should be, "Solve my problem." Instead of all the bells and whistles, users first need a package that services them. It should be easy to use and functional, with good documentation. And if I were an MIS manager, I'd look for a command-driven system instead of a menu-driven one.

Why do you favor command driven over menu driven?

A menu-driven system, if I can use a car metaphor, gets you from zero to 20 very rapidly. Then it gets very sluggish. A command-driven program, along with an on-line Help facility, may take a little longer to learn, but once you get up to speed, you get lots of functionality without having to tab through all the menus.

What else is important?

Machine and device independence. Once the users get acclimated to a particular graphics package, you want to be able to shift them over to another set of hardware, if necessary. You want to be sure the package will run on other kinds of hardware. And, ideally, it should port down to the personal computer. If the whole package won't port down, it should at least be accessible from the personal computer.

All right. We've zeroed in on functionality, ease of use and portability. What comes next?

Performance. Some packages can chew up a lot of computer resources. There's a myth going around that you can rely on virtual memory to solve all your problems, but eventually it's going to drain the resources on the CPU. There's a balance that vendors must be concerned with. Do you need something that can slice bread and puree carrots, or do you need something that draws good-looking graphs and charts?

You haven't mentioned training. Don't you think, especially with a command-driven system, that training is important?

Training for the project leader is important; for the rest of the users, it's critical that documentation be excellent — documentation, plus on-line Help and a good tutorial. It's best if people can leaf through the documentation while they're using the package, and then access the Help facility if they get into a snag. You know, there are no really user-friendly packages out there. The menu-driven system is more user-friendly, but you lose functionality. And MIS managers should be cognizant of the 80-20 rule: 80% of the use is by people who enter material into predefined layouts, and 20% is by layout designers. Generally, the layout designers don't require a lot of training.

What about compatibility with mainframe data base formats?

The graphics package should be compatible with a variety of formats. What we're talking about is a character-type format instead of a binary format.

There are so many different packages on the market today. If functionality, ease of use, data base compatibility and portability are there, what would be a deciding factor?

All other things being equal, the MIS manager should choose the vendor that has a reputation for delivering quality products. Look for a company that's been in business for a while, one that can supply good customer references and provide local support. Support is really important. The manager needs a technical person who will come in to install the product and will fix problems as they occur. MIS directors are looking for a safe decision, and you can't blame them for that.

There's one criterion that's notably absent. What about price?

Price comes in pretty low on the totem pole. If you look at a fully costed programmer going for $6,000 to $8,000 a month, the cost of the graphics software seems incidental when compared with the productivity of these people. Usability is much more important; you don't want to spend too much trying to find out how to use it.

Do you have one final qualifier for the poor MIS manager who can't catch a breath between buying decisions?

Yes. Look for superior customer service. From a vendor's point of view, the money is to be made from the sale of multiple systems. Technology sells the first system, but great customer service is what sells multiple systems. Get those references from satisfied customers.

Manager's Corner

By Michael E. Lawson

Between six million and eight million computers are currently in use in the U.S. alone, and over the next few years these numbers should grow even higher. Although most people expect this technology to offer real increases in productivity and efficiency, the arrival of the technology is often accompanied by negative reactions.

These negative feelings can be frustrating for management information systems (MIS) professionals who are very comfortable with the existing technology and who often constitute a driving force for innovation. When resistance is high, the implementation of systems can be impeded and the effective use of the technology impaired, resulting in frustration for users and developers alike.

When any new technology or system is introduced, a number of concerns will be present, whether they are voiced by the affected people or not.

The first of these concerns is that people will be worried about their jobs. It is irrelevant whether the concerns are based on fact; if the fear is real, people will be affected.

Second, people are often intimidated by machines. They will be concerned about possible changes that may occur in the work place. They will also want to know how the value of their contributions will be affected, and if they will be able to cope in the new environment.

Third, computers can lead to a situation in which more work is done at home or in other isolated environments. This in turn can adversely affect interpersonal relationships and create a sense of separation from the organization.

Finally, the new technology offers an increased ability to monitor and measure performance. This may sound terrific if you're a supervisor, but it can create real apprehension for those who are supervised.

An MIS manager will be aware of these concerns. Armed with this information and the knowledge that the technology can, in fact, improve the quality of work and the work place, you can take the following steps:

• Insist that management take the necessary steps to ensure that users' interests and needs are fully incorporated. Up and down the reporting channels, people need to know what is going on and what they can expect. They need to be involved from the start.

Fears and concerns can be turned into very positive and helpful attitudes if people believe their input is actively sought, listened to and, where appropriate, incorporated into the planning and implementation process.

• Encourage managers to address the issues of job security and intimidation. Candor and commitment to career reorientation are essential when particular jobs are to be eliminated. Companies must develop educational programs that can bring users up to speed and, to reduce anxiety, must emphasize the positive aspects of using the technology.

MIS professionals can also help make sure that other managers do not develop unrealistic expectations about the amount of time it takes people to become comfortable and productive with the new technology.

• Help management to clarify the specific reasons and goals associated with the introduction of the technology. Clear goals and objectives make it easier for everyone to understand the importance of the change and to rationalize some of the short-term disruptions.

• Share with other managers your understanding of the impact of change. The effective implementation of any new system will proceed more smoothly and will lead to long-term gains in productivity when the company is committed to understanding the impact change can have on people. The information systems department has had more experience with systems and technology — and perhaps with change — than other parts of the organization have had. This experience and knowledge must be shared with those who will be responsible for the implementation process and ultimate use of the technology.

In combination with good decisions about hardware, software and systems, these additional steps can lead to a better implementation process and a more productive system.‡

Lawson is director of the Masters Program in Management Information Systems at Boston University's School of Management.

Correction

An editing change in an article in last month's issue ("Integrated Software — Past, Present and Future," *Computerworld Focus*, March 20, 1985) inadvertently caused the vendor names to be interchanged on two products. The correct references follow: Enable is from The Software Group, Inc., and Electric Desk is from Alpha Software Corp.

In the News

Belt-Tightening At Apple, IBM and Wang

In mid-February, Steve Wozniak, one of the founders of Apple Computer, Inc., announced he was leaving Apple to pursue other interests. It was widely reported that Wozniak had disagreed with the company's overall direction. At the end of February, Joseph Graziano, Apple's chief financial officer since 1981, resigned. Soon after these bulletins, Apple announced that the company would stop production for one week at each of its three Apple II plants and its Macintosh plant, citing large dealer inventories and soft sales as reasons for the shutdowns.

Greg Kelsey, partner in L.H. Alton and Co., a research and consulting firm in San Francisco, stated he wouldn't try to read more into it than meets the eye, and the three events are pretty unrelated. Kelsey said he was surprised when Wozniak went back to Apple a year ago, but that he knows Graziano well and was aware he wanted to get out of the high-pressure fray, which he'd been involved in for a number of years.

Perhaps the personnel changes are coincidental. But a larger problem looms on the horizon. Lotus Development Corp.'s Jazz, the long-awaited and much-heralded Lotus 1-2-3 lookalike for the Macintosh, is going to keep its heralders waiting a bit longer. Jazz was originally to ship in March, then April. Now the date is set for May 27. The uncertainty surrounding Jazz could mean fewer Macintosh machines sold and a more difficult fight in entering the offices of big business.

Apple doesn't hold the patent on bad news. The latest word on the home computer market comes from IBM, and that word is "halt." The decision to cease production on the PCjr as of this April comes hard on the heels of Apple's week-long moratorium on manufacturing the Apple II and Macintosh computers. An estimated 100,000 PCjr computers are still in inventory.

Evan Moltz, director of Microservices for International Data Corp., a research firm in Framingham, Mass., said the decision indicates that IBM has finally admitted there is no such thing as a home computer market — except in December. "You can sell almost anything at Christmas," Moltz said. Bob Miller, president of Computerland of Worcester County, Mass., expressed disappointment at the news, especially in view of the tremendous number of PCjrs sold in the last quarter of 1984. "There's an installed base out there expecting more software products, especially educational products. A lot of customers purchased the PCjr for that reason." However, Miller has not sold any units since Christmas. He has a reason for disappointment that goes beyond the store's balance sheet: He bought a PCjr for his family for Christmas.

And to round out the news, all employees in the domestic manufacturing facilities of Wang Laboratories, Inc., in Lowell, Mass., will take a common vacation — the first two weeks of July 1985 — according to Paul Henning, director of Public Relations at Wang. When asked whether a common vacation was a common occurrence, Henning replied that it only occurred once before, "sometime in the mid-70s."

In Brief

NATICK, Mass. — The hard-copy graphics market will reach $12.3 billion by 1990, and of the three segments of the market — plotters, printers and camera systems — camera systems will experience the greatest growth with a forecasted compounded annual rate exceeding 68%. Venture Development Corp.'s market study, entitled "The Multicolor and Single-Color Hard-Copy Graphics Industry through 1990," also reported that drum plotters will continue to grow at a compounded annual rate of 30.4% and moving media flatbed devices will demonstrate the highest rate of growth with dollar shipments expected to be nearly 10 times the 1984 rate in 1990.

Further information regarding this 300-page report, which is available for $7,500, can be obtained by writing to Venture Development Corp., 1 Apple Hill, Natick, Mass. 01760.

FAIRFAX, Va. — The revolution in printing and publishing is on-line text editing and page makeup, combined with computer-generated charts and graphs, and this revolution will be given in-depth coverage at the National Computer Graphics Association Conference in Dallas, April 14-18, 1985.

Among the participants is Alan T. Paller of AUI Data Graphics/Issco, who will head a special printing and publishing track on Thursday, April 18. In addition, there will be extensive tracks dealing with visual arts and design and business and management graphics. In special sessions on Sunday, April 14; Wednesday, April 17; and Thursday, April 18; biomedical technical sessions will be held. There will also be a concurrent exposition featuring over 200 vendors of hardware, software and services spread over seven acres of floor space at the Dallas Convention Center.

Details and registration information are available from the National Computer Graphics Association, 8401 Arlington Blvd., Fairfax, Va. 22031.

What's New In Slide Makers?

What's new in slide making? Two authors present their views: Kathryn Alesandrini focuses on technology and Lee White compares some products.

By Kathryn Alesandrini

With microcomputer graphics, what you see is not always what you get. Have you experienced the letdown of dreary dots when printing out colorful screen graphics on a dot matrix printer? Or maybe you've suffered from the giant jaggies when the little jagged edges of screen graphics turn into giants when projected on a large screen. Don't give up! Now you've got connections — new combinations of hardware and software can transform you and your microcomputer into a graphics workstation, turning out snappy full-color graphics at a fraction of the cost of traditional graphics. Truly state-of-the-art graphics is usually created on mainframe and minicomputers, complete with high-resolution film recorders that create picture-perfect slides. But now with the addition of communications capabilities, you've got the ingredients for a micro graphics workstation that results in perfect output. All you need is your IBM Personal Computer with a standard color card, graphics software and a modem (optional if you'd rather use postal communications).

Computer graphics is good for business. Studies show that when visuals are used in a presentation, the audience remembers about 90% of the information. Remove the graphics, and they remember only 10%. The added bonus of using graphics software is that you don't need to be an artist or programmer to create eye-catching graphics that look like they came from the art department.

Be careful not to overdo it, however. Although colorful visuals attract attention, they can do more harm than good if images are oversimplified, distorted or irrelevant to the points you are trying to make. Some people use decorative graphics to liven up presentations and to add interest value. Decorative graphics can backfire when they distract attention from the important information and direct it to the frills. Dressed up word slides (ornamentation added to verbal slides) are an example of the misuse of graphics software. They may be cute, but they can do more harm than good in a presentation. Always use graphics to drive home the most important points. Keep in mind that word slides are not graphics. Too many presentation visuals are actually all words. Word slides do not capture the attention of the audience the way graphics presentations do. Images are much more memorable and fun to view. The quickest and cheapest way to get color slides from your personal computer is to point a camera at the screen and take a picture. Several available products make it nearly foolproof to shoot color slides from your color monitor in a matter of minutes. The main drawback to shooting from the screen is that slides will be no sharper than what you see on the monitor. Also, the monitor is slightly curved, and photographing a curved surface gives the slide a wraparound look. The real problem is the lack of high resolution.

Resolution refers to the number of dots or pixels (picture elements) in the image. The finer the detail in the image, the higher the resolution. As a point of reference, IBM PC color graphics is 320 by 200; Apple Computer, Inc.'s Macintosh has an impressive 512- by 342-display screen, although it sacrifices color. IBM's new Enhanced Color Display is 640 by 350 pixels, with a price tag of $849 for the monitor and $524 for the upgraded graphics card. With the standard color monitor, the new graphics card gives you a resolution of 640 by 200.

But for perfect-looking graphics, you need to have 2,000 by 2,000 for print graphics and 4,000 by 4,000 for slides that will be projected. You cannot approach the truly high resolution of mini-

(Continued on Page 8)

By Lee White

As anyone involved in computing knows, the name of the game — the fun game, anyway — is graphics. And the best part of graphics is not looking at pictures on the color monitor, but showing the pictures to others.

Most people agree that color graphics gives a presentation more punch. Users haven't done much in this area because color printers and low-cost plotters are relatively new to the marketplace and outside slide makers are expensive. What has had to suffice until now for most presenters is the transparency (also known as the overhead or foil). These were rarely in color because they were usually created on a transparency maker or copier/duplicator. However, transparency film is available in color, so users had the distinctly exciting choice of black print on green, yellow, red or blue.

Transparencies have been the bane of many a speaker: At a crucial point in the presentation it would be discovered that the slides were stuck together from static electricity, or were placed upside down on the projector table or, more than once, a whole batch would slide to the floor, sucking up rug dust. Another disadvantage with transparencies is the inability to duplicate innovative art. The presenter was limited to printer output and, even if there were a color printer or plotter available, color choice was limited by the number of bands on the printer ribbon or the number of pens on the plotter.

Recently, there has been a rash of announcements of slide makers in price ranges wide enough for any user's pocket. Some slide makers utilize their own graphics software; others are compatible with most readily available graphics software packages. Some of the more expensive and sophisticated equipment offerings have tablets that enable the creation of original art; even the less expensive ones allow some variations in color choices.

The great dividing line on the slides themselves is resolution. The better models eliminate the jagged lines seen on computer display monitors. Slide resolution capabilities of 4,000 line/in. is equal to excellent photographic reproduction.

Following is a sampling (six products, which fall into four categories) of what's available in slide makers. The first three products, AVL's Starburst and Genigraphics Corp.'s SC2 and Series 1000, are full-function slide presentation systems. They not only allow for immediate slide (or hard-copy) output from computer-generated graphics, but also provide for artistic input. The second two, Calcomp Imaging Products' Samurai and Matrix Instruments, Inc.'s Matrix PCR, are quite sophisticated and are capable of fine slide resolution output, but do not provide the user with the capabilities of freehand-art input. The third, Polaroid Corp.'s Palette, does not give high-resolution output, but does offer the user some good flexibility for color choices. The last product, Eastman Kodak Co.'s slide maker, which is actually a collection of products, photographs the display monitor. The price differential from the first group to the last product is great, but to compare them without explanation would be like comparing Rolls Royces with Rabbits.

AVL (formerly called Audiovisual Laboratories) of Tinton Falls, N.J., recently announced the Starburst Computer Graphics Presentation System. Starburst offers a turnkey system comprised of a 512K-byte CPU with a 10M-byte Winchester hard disk drive and a 5¼-in. floppy disk drive, a puck (similar to a mouse) and digitizing tablet, keyboard and 12-in. monochrome monitor. Users may select either a 12-in. or 19-in. color display monitor and either of two high-resolution film recorders.

(Continued on Page 10)

(Continued from Page 7)

computer and mainframe graphics, even if you spend money on upgraded graphics capabilities for your micro. Of course, one way to get high-resolution output from a personal computer is to buy software that takes away the rough edges and a film recorder that creates a high-resolution slide. Slides can even be enhanced by top-of-the-line graphics workstations if you want special effects or graphics symbols added to your slides. A library of prestored images and symbols can be added to your slides for a set fee. For a price, your slides can include the full range of graphics including free-form graphics.

However, it's not what you can do with graphics enhancement services, it's what you cannot do that may be a problem. The limitations stem from the fact that not all graphics are alike. Only certain types of personal computer graphics can be transferred for enhancement — the kind that can be reduced to device-independent and resolution-independent primitives (lines, rectangles, polygons and so on) and their attributes (such as color, width and texture). What about most of the pictures created with the draw/paint graphics software and microcomputer libraries of predrawn images? The images from those packages cannot be enhanced because they are bit-mapped graphics. They are composed of a collection of dots that our eyes can organize into recognizable shapes, patterns and objects, but there is no organization or meaning to the dots for the computer. A curve cannot be smoothed unless the computer knows that a series of dots is supposed to be a curve. When an image has been created with individual dots rather than objects, the computer does not know a line from a circle. The main limitation of enhancement services is that they cannot act on graphics software that stores images as a collection of dots. Many of the business graphics

If visual appearances are very important to you but you are on a limited budget, you might consider a graphics enhancement connection service. Other than your standard color personal computer, your only investments are the software and a standard modem for data communications. The graphs created with your graphics package (within limits) can then be transmitted to a service center for enhancement and returned as 4,000 by 4,000 picture-perfect slides. Imedia Corp.'s support package, PC Presents, automatically converts Lotus Development Corp.'s 1-2-3 graphs into code that can be communicated to the high-resolution film recorders in the service center network. The cost is $350 for software, $15 for one-day service to image an original slide and $23 for an overhead transparency. You don't even need a modem; the centers accept graphics on disk. This service is good for word slides and the standard business graphs, but lacks free-form graphics.

The more sophisticated Genigraphics Corp. Series 1000 system (based on an IBM PC) does not even allow freehand drawing. It does, however, include a digitizer that lets you create original graphics that can be transmitted to a Genigraphics Production Center for high-resolution slide output. The Genigraphics system allows a wider range of graphics for high-resolution imaging than does PC Presents, but the upgrade kit for the PC costs $12,500 and you still can't get the kind of images you can create with the standard draw-and-paint software in lower resolution.

Another entrant in the area of graphics enhancement services is Dicomed Corp.'s Presenter PC. With the addition of a high-resolution graphics adapter card to your personal computer, you can use Presenter PC ($995) to create presentation graphics that can be imaged up to 8,000-line resolution. Presenter PC software allows the full range of charts and graphs, text with 360-degree rotation and original (but not freehand) graphics.

With Presenter PC you can tie into the Dicomed system through phone transmission using the high-quality image re-

software packages in use today use bit-mapped graphics and cannot be transmitted for enhancement.

Why does everyone want such high-resolution graphics anyway? People enjoy viewing realistic colorful graphics. Yet there is another, perhaps more important source of realism. The nature of the information being imaged may be realistic or abstract. Numerical data and words, for example, are inherently abstract. Objects, events and people are concrete and realistic.

Images are realistic and concrete compared to abstract verbiage. That's why graphics presentations are interesting and easy to remember. There's nothing dull or abstract about graphics — or is there? Actually, not all graphics are created equal. Some are more realistic than others. Charts and graphs, for example, are more abstract than realistic drawings of objects. Yet realism is important in visual displays because people enjoy viewing concrete, realistic images.

The advantage of including truly realistic graphics in your representations is that people will pay closer attention to your ideas.

The good news is that you can make your presentations more interesting and influencial if you spruce up your abstract graphics with realistic images.

Abstract graphics such as bar charts and pie charts may elicit fewer yawns than verbiage and data tables. But if you really want to catch people's interest, you need realistic images of people, places and things.

By providing hundreds of predrawn figures, some of the new software packages make it easy to add realism to a presentation. All you do is electronically cut and paste the images, changing colors and adding other personalized touches. The result is colorful, realistic graphics with a customized look. But for now, you must give up high resolution to achieve this look with your personal computer. Software such as Prentice-Hall, Inc.'s VCN Execuvision provides collections of realistic graphics and symbols called libraries that you can pick and choose for your own use. The library collections include borders, initials and decorative designs; an industry and business catalog; the world's faces and figures as well as maps and international symbols. Other libraries scheduled to be released include health and fitness, finance (banking, stocks and bonds, taxes and so on), transportation (vehicle and travel-related images) and computer and computer applications.

With predrawn graphics, you can spruce up a boring bar chart by combining it with a realistic drawing that depicts the topic of the data. You not only increase the interest value with realistic images, but you also make the information easier to remember.

Nothing is perfect. Although you can connect your personal computer to a graphics service center for perfect slide output, the process is flawed by the restrictive range of visuals that can be created. Dicomed's enhancement service is one solution to the restrictive range of visuals — at a price. Basic enhancement services are well suited for those who use only word slides and standard graphs in their presentations. Yet, anyone using only those options may be missing much of the potential benefit of graphics. Word slides and standard graphs may not be interesting enough to hold your audience's attention. If you go to the time and expense to include graphics in your presentation, you want the full benefit. There is no guarantee that by getting rid of giant jaggies, you can also eliminate the so-called audience-eyelid-saggies.

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(Continued from Page 7)

Three major software programs are included: Artgraphics, for creative free-form designing with the puck and digitizing tablet; Chartgraphics, for creation of three-dimensional horizontal and vertical cumulative bar charts, three-dimensional pie charts and area and line charts; and Quick Show, which allows the user to sequentially arrange all design files and then review them in presentation sequence for rehearsals or final edit analysis. Also built into Quick Show is the ability to design during the day and allow the system to record finished material on film at night through the system's high-resolution film recorder control routines.

Starburst Computer Graphics Presentation System, priced at $42,000, has many features that were previously available only on systems costing well in excess of $100,000. Output includes combinations from 256 displayable colors from a palette of 16.7 million colors, and slide resolution is 4,000 lines. The drawback to Starburst is that it is a pure stand-alone system with no ability to access either information from data bases or other graphics packages on mainframes or personal computers.

Ron Rudolph, of Ducks, Unlimited, a private conservation group involved with funding for wetland habitats, creates the slide presentations used for various fund-raising and meeting functions. Before his group got Starburst, slide presentations were done manually. "We had to do keylining and pasting, do a [Eastman Kodak Co.] Kodalith, then we stripped gels and then we shot it on a light table. It was pretty time-consuming." Although the volume of slides produced has not been high, word of Starburst's existence at Ducks, Unlimited has gotten around, and Rudolph figures they could be creating 1,000 original slides this year. They will create multiples of the originals so sets of slides can simultaneously be used by people in different locations. In addition, they program the Starburst to operate unattended at night. "In the past we've been up 16 to 18 hours each day for a week to get the job done. This time it was just 8:30 to 4:30. So we enjoyed it." More information about Starburst is available from AVL, 56 Park Road, Tinton Falls, N.J. 07724.

Late in 1984, Genigraphics Corp., in Liverpool, N.Y., announced the Genigraphics SC2000, a self-contained computer graphics console and film recorder priced at under $100,000. Operational features of the system include a palette of 16 million colors with 64 colors available for use in a single slide; four type fonts; and complete file management for reading, writing, reviewing and copying records. Special software is available for freehand art, additional type fonts, texture and black-and-white hard-copy output.

If potential customers decide not to purchase the film recorder as part of the Genigraphics package, they may purchase the SC2 alone at a cost of $36,850. A communications feature enables users to transmit work to the film-recorder for production as 2,000-line or 4,000-line high-resolution slides, viewgraphs and transparencies. Genigraphics also has 23 service centers nationwide to which tapes can be sent for slide production. Although the SC2000 system is primarily a stand-alone system, it is compatible with Integrated Software Systems Corp.'s (Issco) mainframe graphics software.

At the other end of the Genigraphics spectrum is the Series 1000. The Series 1000 is available as a total hardware and software package, based on the IBM Personal Computer XT, which sells for $17,000, or as an upgrade to the IBM PC or PC XT for $11,000. Neither of these prices include the film recorder.

The Series 1000 is able to read Dif files from other software packages, so a spreadsheet created in Lotus Development Corp.'s 1-2-3 can be brought down to the Series 1000 software for chart creation. If a decision is made not to purchase the film recorder, the Series 1000 can be hard-wired or telecommunicated to an in-house Genigraphics film recorder for slide production. The 23 Genigraphics service centers can also be used for slide production needs. There is generally a 24-hour turnaround time to the service centers.

The Series 1000 is in beta test sites now, and no further information could be obtained. Genigraphics Corp. can be reached at P.O. Box 591, Liverpool, N.Y. 13088.

Calcomp Imaging Products, which was called Image Resource Corp. before it was bought by California Computer Products, manufactures the Samurai, a complete business presentation graphics system. According to Calcomp, Samurai was named to conjure up images of skill, precision, swords and cutting edge and costs $11,950 plus $495 for the optional Image I graphics package.

Samurai is compatible with the IBM Personal Computer, PC XT, XT 370 and the 3270 PC. In addition, drivers will soon be available that render compatible mainframe graphics systems, including IBM's Graphics Display Data Manager (GDDM), Issco's Tell-A-Graf and SAS Institute Inc.'s SAS/Graph.

Roberta Aronoff is project coordinator for Samurai in the Decision Support Department at GTE Service Corp. in Stamford, Conn. Her group has responsibility for installation, implementation, documentation and training on a variety of mainframe software products. GTE is awaiting delivery of the driver, which will allow Samurai to work directly with its mainframe software product, Tell-A-Graf. Aronoff used the driver with Samurai at Issco Week in San Diego in late February, 1985. "I had an opportunity to run out slides [at Issco Week]. They looked very, very good."

Samurai is also compatible with most microcomputer graphics packages, with the notable exceptions of Zenographics, Inc.'s Mirage (for which a driver will soon be available) and Decision Resources Co.'s Chartmaster. The limitation to Samurai is that any graphics package must download to the personal computer to which Samurai is attached, and Samurai can only reside on one personal computer.

Samurai's ease of use should balance out any disadvantages, however. To generate a slide, all the operator has to do is develop an Image I chart form and display an image on the monitor. If the image is correct, the operator commands the computer to output the image to film, paper, display screen or communications network.

Slide resolution of 4,000 lines is very high for an inexpensive system, but Calcomp claims the Samurai produces such a result.

More information about Samurai is

available from Calcomp Imaging Products at 733 Lakefield Road, Westlake Village, Calif. 91361.

The Matrix PCR is Matrix Instruments, Inc.'s entry in the automated film recorder market. The Matrix PCR sits on the floor at desk side, and the controls are at desk height.

The Matrix PCR interfaces with the IBM PC, PC XT, PC AT, XT 370, 3270 PC and IBM PC-compatible computers as well as many mainframe networks and minicomputers. It is also compatible with most major microsoftware packages including Lotus' 1-2-3 and Mirage. In addition, it runs with Tell-A-Graf, SAS/Graph and GDDM mainframe graphics software. The PCR produces slides in the 2,000-line resolution range. As with Samurai, the personal computer is used as controller.

The Matrix PCR is presently in advanced beta sites for Matrix's OEM customers. One of those advanced beta sites is Images II Graphic Systems in Lincoln, Neb. Images II designs and produces three-dimensional graphics systems for slide, video and color hard-copy. They have developed a series of software programs and hardware processor boards that offload the personal computer while still allowing the universal interface of the IBM world. Reg Johnson is general manager of Images II and has been using the PCR since early January. Johnson said that results of the tests they've conducted have shown the PCR to be much superior to the Matrix QCR in shading and handling of colors. Although the slide output is only 2,000-line resolution, the shading and linearity of colors is much better than the QCR running the same slides side by side, according to Johnson.

Although the PCR's technology is similar to Matrix's more expensive QCR, which operates directly with mainframe software via a black box interface, Johnson stated that, "between the two, I think the technology and the things that [Matrix] has done in the PCR are a significant improvement over the level of technology that's in the QCR,"

Jack Russell, supervisor of computer graphics for the New York Treasurer's Office of General Motors Corp., has been using the QCR for almost two years. "We're doing all the presentations for the Board of Directors in N.Y. We probably do 2,000 slides a month from Tell-A-Graf," Russell explained. They are using the Lasergraphics, Inc. rasteriser because the Matrix QCR does not speak the same language as the mainframe graphics program. The QCR produces slides with a 4,000-line resolution, but Russell said that if slide production is the only need, the 2,000-line resolution is more than adequate. The New York General Motors office has no color hard-copy output equipment. Russell stated that color from a printer or plotter is not as crisp as that on a slide, and he much prefers black and white, noting that "it's a well known fact that 10% of the male population is color-blind, anyway." Russell, who has been doing color slides for over four years, is color-blind.

The Matrix PCR sells for $11,000 plus $2,000 for the coprocessor. For more information on the product and delivery times, contact Matrix Instruments, Inc., 1 Ramland Road, Orangeburg, N.Y. 10962.

One of the more interesting products, primarily due to its low price, is the Polaroid Palette. For $1,799, Palette gives you a combination of software and hardware which does not provide the resolution available with the higher cost systems, but is moderately sophisticated.

What Polaroid has done is replace the microprocessor in the film recorder of the higher-priced systems with software. Because Palette is a software-driven system the operator is not limited to the colors that appear on the color monitor. Instead, a set of controls are fed to the Palette exposure unit down an RS-232C cable line from the computer's color graphics adapter board. Because of this, even a monochrome monitor can be used; the operator can define by software menu what colors are to appear. For further convenience — and for those to whom pleasant blending of color is not a natural ability — a series of lookup tables in the software gives immediate access to a series of color sets. There is also a color key, comprised of 72 colors, which are accessed with two keystrokes (one alpha and one numeric) to define a specific color that the operator wants to appear somewhere in the image.

Palette is compatible with the IBM PC, XT, AT and Portable; the Digital Equipment Corp. Rainbow 100, 100 Plus, and Professional 300 Series;, AT&T Personal Computer; Compaq Computer Corp.'s Compaq and Compaq Plus; and Apple Computer, Inc.'s Apple II Plus and IIe. The list of software packages compatible with Palette is a long one, and includes Mirage, Digital Research, Inc.'s DR Draw and DR Graph, Lotus' 1-2-3, and Graphic Communications, Inc.'s Graphwriter.

Although resolution on the resulting slide does not approach the 4,000-line number on the more expensive systems, several software graphics designers have built Palette device drivers that double the resolution on the screen. As an example, on the IBM color monitor the resolution is 320 by 200, but some graphics software packages increase this resolution to 640 by 400.

Polaroid's Palette is being sold by computer retailers. For more information, contact Polaroid at 575 Technology Sq., Cambridge, Mass. 02139.

The last item to be looked at is the Eastman Kodak Co. slide maker. The entire outfit necessary to make slides consists of a slide imager, camera, monitor adapter, slide mounter and slide module. All of the above can be purchased for less than $700. And what you get for $700 is a picture of the graph on the color monitor of your computer. The resolution on the slide will be no better than that on the monitor. The colors will be the same as those on the monitor because there is no facility to change colors. In addition, because the monitor is curved, there will probably be some distortion around the edges.

Kodak's slide makers are sold through audiovisual equipment dealers. For information about dealers in specific areas, contact Eastman Kodak Co., Motion Picture and Audiovisual Markets Division, 343 State St., Rochester, N.Y. 14650.

The emerging range of products enables users to determine their needs and then balance them against the cost and performance levels available in the product groups.

White is senior writer at Computerworld Focus.

The Ten Top Graphics Trends For '85

By Alan Paller

The next 12 months will be a watershed year for computer graphics in business. The technology is no longer considered a frill. Today, nearly every large company recognizes that computer graphics can be a powerful competitive tool for research, marketing, planning, engineering, data processing and financial management. Most companies have targeted this coming year as the time to expand their investment in computer graphics.

Rapid growth and change in the computer graphics field leads some potential users of the technology to delay making decisions. They wait for the day when choices are fewer and more certain. While they are waiting, however, their competitors are moving forward, using available technology, learning from it, isolating high-payoff applications and gaining competitive advantages.

Acting confidently is difficult when equipment that was new only months earlier is made obsolete by new announcements. To help decision makers in large organizations take advantage of this fast changing market, some trends will be identified and some recommendations for action will follow.

Leading-edge users are pioneers that have already begun using equipment and applications that will be important for four to five million new users of computer graphics over the next three years. Some trends can be seen in the way these leading-edge users run their offices. Other trends are not yet in common use but can be seen in the directions currently showing up in the new products of leading U.S and Japanese vendors. Some of these products will alter the technology we use for computer graphics. A clear picture of major trends in business graphics emerges when the experiences and desires of leading users are combined with the announced and soon-to-be-announced products of the leading vendors.

Low-cost laser printers: The new laser printers are fast, reliable and inexpensive. A single printer, costing less than $15,000, can serve the high-quality, black-and-white graphics needs of dozens of users.

Although the printer is not making charts, it does excellent text printing. It can even integrate text and graphics. The key to its effective use is its installation as a peripheral on a shared computer. There it can be accessed from terminals, communicating personal computers and batch jobs.

(Recommendation: In 1985, the acquisition of one or more graphics laser printers would be wise.)

Ink-jet printers and color thermal printers: Ink-jet printers have had little success in the business graphics market. In 1985, however, their fortunes should begin to improve because of three developments:

- More speed — up to one page per minute.
- More resolution — up to 180 dots per inch.
- Hardware rasterizers that off-load picture processing.

A high-speed ink-jet printer with a hardware rasterizer provides reasonable quality color charts and can be used as a shared graphics printer. It will be found alongside laser printers in many organizations. The laser will provide high-volume black-and-white graphics; the ink-jet will meet color requirements.

PHOTO © 1985 GEORGE DILLON

The Japanese color thermal printers are an emerging threat to ink-jet printers because they provide similar speed, resolution and price. Several new varieties are scheduled for 1985. Look at both kinds of printers when you look for color hard copy.

(Recommendation: Organizations that are not providing shared color graphics hard copy now might consider action in this area in 1985.)

Micro-mainframe graphics linkages: The majority of today's personal computer users have no access to high-quality graphics hard-copy equipment. Only about 10% of the personal computer users purchased digital plotters, and most of them found they were forced to stand by the plotter feeding it paper when they needed charts. Their time was too valuable to become plotter operators.

One major trend attempts to solve the problem of access to high-quality hard-copy equipment by linking micros to mainframes for graphics. In 1984, users created the link by making the personal computer into a graphics terminal by means of software or hardware extensions to their personal computers. They requested charts from the personal computer, previewed them there and routed them to high-quality shared graphics equipment like film recorders, laser printers and continuous plotters.

In 1985, the trend of personal computer-as-graphics-terminal will continue, but it will be complemented by a new trend linking programs such as Lotus Development Corp.'s 1-2-3 directly to mainframe graphics programs such as Integrated Software Systems Corp.'s (Issco) Tell-A-Graf. Lotus' 1-2-3 and Symphony will be used in their standard fashion under the new links. Users will look at data and view instant charts in stand-alone mode on the personal computer. When Lotus users make a chart they want to show to others, however, they will use a new "button" inside those packages that will automatically instruct the personal computer to send the Lotus Worksheet to Tell-A-Graf on the mainframe. There it will be converted into a high-quality slide or chart.

(Recommendations: Be sure the personal computers you buy have communications capabilities. Be sure the high-quality graphics hardware you buy for your mainframes is installed as shared devices. Acquire the linkage software when you need it.)

Interactivity: Interactive capabilities will begin to emerge in business graphics software, offering users the ability to point to the location where labels and messages are required. Interactivity is the strength of paint programs such as Dr. Halo and Macpaint. Now, bar chart, line chart and pie chart programs will also begin to have this interactive capability.

The interactivity trend, which was apparent in personal computer packages in 1984, will also be seen in 1985, especially in mainframe graphics software.

(Recommendation: None. No action is needed in this area because software vendors will offer interactivity as an update to existing software.)

Graphics standards surprise: Graphics Kernal System (GKS) has now officially eclipsed Core, the old Siggraph proposal. The leading graphics software vendors have embraced GKS, offering graphics software package options that comply with the GKS standard.

Because GKS is perceived as a device-independent standard, most buyers think GKS will make their software support all graphics equipment. However, users are in for a surprise when they learn that GKS software in no way guarantees that any particular graphics device will be supported. Unless the software vendor supplies a device driver, each graphics device will be incompatible with GKS software.

(Recommendation: When buying new hardware, users should ask their software vendor, not their hardware vendor, whether a graphics device is supported by the software.)

The mainframe on the desk: IBM Personal Computers will appear offering more power and new operating systems. Today's IBM PCs will soon be eclipsed by new waves of IBM equipment and software.

The IBM Personal Computer AT will soon be joined by a series of new IBM PCs that will run the VM operating system. VM is one of IBM's most popular

mainframe operating systems. With the new operating systems, these PCs will be target machines for mainframe graphics software, especially Tell-A-Graf and Disspla, both from Issco. User organizations will then be able to offer a uniform family of graphics software tools on all machines from the mainframe to the desktop.

(Recommendation: This trend will not lead to a need for action item until late in 1985. However, many large organizations have delayed acquisition of PC graphics packages, other than Lotus and paint programs, until they learn which desktop computers will run the mainframe graphics software they already have.)

In-house publishing: Billions of dollars are spent each year in typesetting, line art, plate making and printing to prepare documents for publication. Until 1985, automation played a small role, but new hardware and software will allow the computer to do more of the job. When it comes, automation will lower costs and increase responsiveness of the publishing process.

Some commercial publishers — *Time* magazine, for example — have already automated the color control and page layout process. In-house publishers, particularly those in the automotive and aerospace industries, are next. Commercial publishers bought systems that were oriented toward color and that cost millions of dollars. Newer systems for in-house publishers are oriented toward black-and-white publishing. They solve the publishing problems of technical documentation, and their prices are plummeting as low as $100,000 or less. Organizations with multimillion-dollar publishing bills find these lower cost systems cost effective.

Design workstations and mainframe-based publishing systems will both gain from this trend. Stand-alone design workstations will be purchased for smaller jobs. Mainframe-based publishing systems will be acquired where large numbers of pages must be created. Mainframes will also be used where text and graphs are created on word processors and graphics software and need to be brought together for final publication.

Most buyers think GKS will make their software support all graphics equipment.

(Recommendation: Search for applications immediately. Wait for new product announcements before you buy.)

Graphics project management systems: Project management systems are among the oldest management application of computers. These packages calculate schedules and budgets. They report on tasks that need to be completed by a particular date, and they determine the critical path. Most large companies have project management systems, but they are not as effective as they should be.

A new class of graphics project management software is being recognized as an important improvement over older systems. Organizations have found that graphics project management systems are being used 10 to 100 times as much as the older project management systems. Where older systems were used only for the largest projects, the new tools are popular for every project on which schedules are important: auditing, computer systems development, research, marketing and dozens of others. Part of the difference is ease of use; the new system can be learned and used very quickly by secretaries and managers. A more important reason is the ability of the new system to produce presentation quality charts that show management the schedule and cost status of projects.

(Recommendation: Adding graphics project management to your computer is an action item for 1985 if you have a Digital Equipment Corp. VAX, Prime Computer, Inc. or IBM mainframe. If you have only a personal computer, you may

want to wait for the next generation personal computers. The personal computer software does not offer the needed flexibility and quality.)

Graphics expert systems: Few of the millions of users of graphics are experts on design. so new software tools have been created to assist those users make charts that look right. The new tools offer three knowledge-based functions: chart-books, layout intelligence and color palette selection. Chart-books are predesigned graphics. Users tell the computer. "Make chart 25." The computer looks up the data or asks for it and then makes the chart. Because the charts were designed by professionals, they look good.

Layout intelligence relies on a data base of facts about how to format charts. Examples are how big to make charts so they will fit inside overhead transparency frames, what the length-to-width ratio should be for 35mm slides and how large to make the chart and the lettering for quarter-page or half-page publication charts.

Color pallette selection solves the problems created by new graphics systems that offer thousands of colors. Smart graphics software chooses combinations of colors that look good together. The user asks for a "look" such as spring or winter. The software selects a pleasing set of colors.

(Recommendation: No action is necessary on this trend. Leading graphics software vendors are adding these capabilities to their products. You will get the new capabilities with updates of those products.)

Visual early warning systems (graphics decision support systems): Software tools are beginning to offer push-but ton graphics management fo executives. The new tools mee the needs of executives. Tradi tional computer graphics soft ware packages served the peopl who created charts, but didn serve the needs of manager who just wanted informatio and wanted it graphically.

Today, organizations fro London to Los Angeles ar building or buying new system that instantly deliver informa tion in graphics formats at th

The new software tools meet the needs of executives.

touch of a button. Of the 10 largest organizations in th U.S., 20 have already built or o dered such systems, and half o the rest plan to put them in du ing 1985.

The systems are variousl called visual early warning sy tems or graphics decision su port systems (DSS). They co sist of libraries of charts an tables, automatically update whenever the underlying dat changes. Every chart is availab at the touch of a button. Anot er button starts automatic cr ation of 35mm slides, overhea transparencies and paper chart

Visual early warning system have been created on compute ranging from Altos Comput Systems, Inc. micros to IB mainframes, but the trend is t ward the mainframes for this a plication. The mainframe needed because the data is o the mainframe and becau many people need to share t information in those chart Only the mainframe offers t combination of data, graph software, storage capacity a network, all essential for t success of these systems.

(Recommendation: Impl mentation of a visual ear warning system should be t first priority for compu graphics in 1985. Pent-up d mand for these systems is en mous.)

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places the number of micro users in excess of the estimates for users of the leading mainframe software. If three micro users per copy are assumed — still a conservative estimate — the ratio rises above 2:1.

Perhaps the most interesting aspect of the way the boom in business graphics has hit the world of micros is how recently it has all taken place. The growth of micro-based graphics came just in time to save the reputation of a number of forecasters. Articles predicting the business graphics boom began to appear in 1982, shortly after the introduction of the IBM Personal Computer and Hewlett-Packard Co.'s two-pen plotter. At that time, many of the industry prognosticators outlined a strong case for rapid growth in micro-based business graphics. They cited the increased number of micros going into business, the low cost of equipping those micros with business graphics capability, the increased speed with which graphics could be produced and the ability of users to produce (and, when necessary, quickly change) their own graphics.

The graphics boom predicted by this reasoning did not materialize in 1982 or in 1983. In fact, by year-end 1983, the installed base of dedicated business graphics software packages for micros was only about 100,000 units, and the fastest growing software program with graphics capability was an integrated product, Lotus' 1-2-3.

The reasons the boom did not materialize are not well understood. Most forecasters simply claim their forecast was slightly premature. Hindsight, however, can identify four basic hindrances to the growth of the business graphics market for micros during the period 1982 to 1983:

- **Low Awareness and Priority** — The first micro users cut their teeth on spreadsheets, data bases or WP. The micro was primarily viewed as an analytical tool, and most business users did not think of graphics as part of the constellation of applications that migrated easily to micros. Business graphics were still perceived as a luxury: expensive, made by an expert and reserved for special occasions.

- **Software Mismatch** — Most micro-based graphics products available in early 1982 had been designed to create charts from the data in a spreadsheet. This application, specifically referred to as analytical graphics, was the dominant force in the first micro-based graphics products. These products were being used as extensions of a spreadsheet; the next step was to integrate directly with the spreadsheet itself. The success of Lotus' 1-2-3 attests to that fact.

With analysis graphics dominating the market for micro-based graphics, the use of micros for presentation graphics was slower to develop. Software developers perceived analysis graphics as the dominant market opportunity, so they were less concerned about producing software that could be used as a presentation graphics tool. Many products were described as presentation quality simply because they produced reasonably legible bar, line or pie charts.

The software available before 1983 had no understanding of what is needed to prepare a presentation. Many products were misused as presentation tools and did cause some embarrassment and frustration. Besides lacking the quality required for a presentation, these products failed to address the most simple of presentation requirements: projection options (overheads or 35mm slides) or the variety of chart types needed to produce an entire presentation. Essential requirements such as word charts, Gantt charts and organization charts were completely missing. Changing data might have been easy enough, but changing the graph was not. Early users tried to do a highly sophisticated task with packages not designed for that purpose, and the products they needed were simply not available.

- **Limited Output Options** — The predicted boom in graphics could not happen in the absence of products that addressed the need for both analysis graphics and presentation graphics. Because the orientation of most micro packages at that time was analytical, most products were screen-oriented. The ability to produce hard copy was a minor concern. In addition, most low-priced output devices that could be reasonably used with a low-cost micro were not capable of producing the quality required for presentations.

In late 1982, a low-cost, high-quality pen plotter became available and ink-jet and other higher quality printing technologies began to appear. This was a major step toward a noncentralized graphics capability. However, it was mid-1983 before these products were adequately supported by software, and their impact on the market was therefore delayed.

- **Price Sensitivity** — For those competing in the microcomputer arena, the dramatic drop in price for output devices in 1982 to 1983 was a major breakthrough. Microcomputer buyers, however, who were already spending $2,000 to $3,000 for initial hardware and software, found the additional $2,000 needed to turn that micro into a graphics workstation relatively expensive. The use of micros had not yet risen to the level in the corporate hierarchy where presentations are considered crucial. In 1982 the willingness of early adopters to spend those dollars was lower than would be the case a year later.

In mid-1983, many of these barriers began to fall. The awareness and priority given to presentation graphics increased dramatically. By early 1984, the boom in micro-based graphics had begun. The early adopters had had time to develop

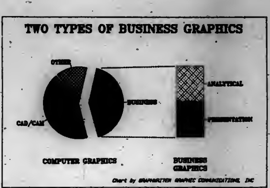

Figure 1. Presentation vs. Analytical

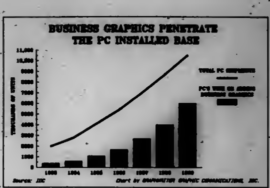

Figure 2. Micros Sold With or Adding Business Graphics

applications with their spreadsheets, data bases and word processors; now they were looking for more things to leverage the power of the micro. The awareness and use of micros had risen to a higher level in corporate America — a level at which presentations and presentation preparation were given a much higher priority.

The enormous success of Lotus in 1983 forced graphics software developers to reevaluate their strategies. Some companies (Mosaic Electronics, Inc. and Peachtree Software, Inc.) focused their resources on producing integrated products; some (BPS Information Services, Inc.) tried to beef up their analytical capabilities; and others (Decision Resources Corp.) attempted to make their charts better looking than Lotus' and moved toward a more presentation-oriented product.

The year 1983 also saw the introduction of the first micro packages designed exclusively for doing presentations, some complete with high-quality output; a full array of chart types (including important capabilities such as word charts, Gantt charts and organization charts); and the ability to produce presentation materials on slides, transparencies and hard copy using the new low-cost output devices. Since that time, numerous presentation graphics products have been introduced for micros. These products offer the micro user a wide choice of presentation tools ranging from freehand draw to symbol libraries to highly structured programs.

Presentation graphics software developers focus on getting output, not integrating with a spreadsheet. Because they devote development resources and constantly improve the quality of their graphics, graphics capability today is significantly better than anything previously produced on a micro. For the first time, the quality of inexpensive charts produced on a microcomputer can be compared to the quality of mainframe graphics.

Plotter technology has brought high-quality hard-copy capability into the domain of the individual user. The introduction of the Polaroid Corp.'s Palette Image Recorder has lowered the price of 35mm

slide production 75% compared with previously available technology. Several packages can produce the Palette slides at four times the resolution of the IBM PC screen (640 by 400 pixels) using standard IBM hardware. For those environments where the highest resolution is required (2,000 by 2,000 pixels), some packages support Matrix Corp.'s PCR and QCR Image Recorders.

The dramatic drop in the price of presentation-quality output devices was essential to the boom in microcomputer graphics in 1984. But another major impact on the readiness of the market has been the success of integrated software. IDC stated that most customers for Lotus' 1-2-3 claim they purchased the software because it was the most powerful spreadsheet on the market. As mentioned earlier, only 40% of the Lotus installed base use the graphics. But the sheer availability of graphics in every copy of 1-2-3 and other integrated software has had a significant impact.

As Figure 1 on Page 19 shows, more than half the dollars spent by business graphics users (for mainframes, minis and micros) are for presentation graphics. As the microcomputer environment moves toward that industry norm, future expenditures for micro users will be more focused on presentation graphics.

Trends seen in 1984 can be extrapolated to give some understanding of the future role of microcomputers in relation to mainframes in the business graphics market. In a recent study, IDC predicted that the percentage of personal computers sold with business graphics capability will increase dramatically over the next four years. (See Figure 2 on Page 19.) In addition, during 1984 only 5% of the personal computers shipped were sold with or added business graphics software. The study predicted a rise to 27% by 1989. Based on these assumptions, IDC predicted the installed base of micro-based business graphics packages will rise from 248,000 in 1984 to 9.8 million by 1989, seriously dwarfing the number of mainframe installations. As this occurs, personal computers will become the dominant graphics workstations in business. As the use of business graphics is democratized, the effect will spill over to spur continued growth and demand for mainframe-level packages as well, though not at the same rapid rate. The mainframe suppliers will discover — just as IBM did — that what is good for the personal computer is good for the mainframe.

Instead of micro products buying market share by interfacing with popular mainframe graphics packages, mainframe graphics packages will buy market share by interfacing with popular microcomputer packages. Mainframe packages will become part of a distributed graphics network, providing the ability to produce the highly specialized visuals not supported by the micro packages. In this manner, the user from a single workstation can produce a presentation using the local microcomputer software as well as the mainframe software on the host.

Microcomputer software companies will increasingly support the expensive, high-end output devices that can be shared through a variety of personal computers via a network. Priced well above the single-user price, these products will become popular elements of personal computer networks with the appropriate software support.

The sheer availability of graphics in every copy of 1-2-3 and other integrated software has had a significant impact.

But the most important future trend is that microcomputer software will continue to improve. These advances will come about as current leaders in the micro market improve their offerings and as mainframe companies attempt to squeeze their products onto micros as well. Because of the difficulty in doing the latter, the microcomputer vendors will most likely continue to lead in terms of both usability and technical innovation. This innovation will include the integration of what are now separate presentation graphics applications into a single family of graphics products that can work together. This increased power will enable users to combine art, graphics, fonts and symbols into individual visuals and documents. This integration could have the same impact the merging of WP, spreadsheet, data base and graphics has had in the multifunction market.

Organizations that can afford to offer users the expensive mainframe graphics capability and the inexpensive desktop alternative will continue to spend resources on both approaches. But as the gap between mainframe graphics and microcomputer graphics grows smaller, the issue will simply be one of cost. When presentation graphics are used as frequently and easily as a business letter, increased use alone will warrant a system that can produce high quality at a low price. Micros with appropriate software can meet those demands today.

Wilcox is vice-president of Graphic Communications, Inc., located in Waltham, Mass.

[illegible]

By Lee White

At Florida Power and Light, business graphics has been elevated to a high art. Graphics plays an important role in the day-to-day operations at FP&L, as does most other end-user computing. The Systems and Programming departments in the Miami and Juno Beach, Fla. facilities consist of more than 300 systems professionals who service 13,000 employees who in turn service a customer base of 2.5 million people.

The company's primary mainframe is an IBM 3084, with 105 3350 disk packs and 1,200 Conversational Monitoring System (CMS) users. Computer planners expect a 100% [illegible] 3084 [illegible] packs. [illegible] designed on [illegible] mainframe terminals and 500 personal computers, most of which communicate with the mainframe. Since they charge back all Direct Access Storage [illegible] (Dasd) time and CPU time, justification falls alone to user departments. According to one department representative, "The [illegible] create applications as [illegible] as we can supply the disk space and the mips (millions [illegible] instructions per second). They [illegible] what they want, and we give them the tools."

Twenty-five [illegible] staff the User [illegible] of [illegible] ing CMS, Focus and Tell-A-Graf. We supply training to meet any kind of need, and most of it we've developed ourselves." FP&L even trains the trainers via a three-day course which uses videotape to point out the rights and wrongs of each trainer's style.

Cross-training is another key ingredient in User Access Services. Personal computer specialists are proficient with mainframe tools, and Information Builders, Inc. Focus specialists learn their way around personal computers. User Access Services staff mem[illegible] themselves as extremely [illegible] and new employees [illegible] have good people-[illegible] University in Miami, is the graphics guru at FP&L.

Goldsmith preaches graphics with an evangelistic zeal that could make a believer out of almost anyone. His office walls are papered with graphs in every size and shape imaginable, all of which were created on the mainframe using Integrated Software Systems Corp.'s (Issco) Ivies Manager with Issco's Tell-A-Graf software. FP&L was an alpha test site for Ivies; and the day *Computerworld Focus* visited, Issco was putting up Version 1.0.

While Goldsmith's [illegible] for his subject is infectious, [illegible] credit to the [illegible]

With a team made up of members from various other departments in the company, including an engineering manager from Fort Lauderdale, a district general manager in the Northeastern division and Marta Carvajal, the Focus expert in User Access Services, they had a comprehensive budget system up and running within eight months, including training of all personnel.

number of graphics terminals in order to ensure that the controllers to which the terminals are attached can handle the load placed on them without impacting other users. And once the graph has been created, the user must dial into one of the 25 asynchronous dial-up lines for hard-copy output on one of the available plotters. FP&L is using many different plotters, including California Computer Products, Inc. (Calcomp) machines in the power plants, but has not yet added color printers to the lineup.

The volume of graphics output at FP&L is staggering. The new Quality Improvement Program group is gearing up to create 600 charts per month. Departments such as Economics and Divisions Planning and Administration have entire books of graphics indicators which are updated monthly and are available company-wide for presentations.

Even as cumbersome a task as strategic planning has been eased with graphics. Goldsmith explained how Tell-A-Graf, tacked on via a file connection to a strategic planning model written by Electric Power Research Institute in Applied Data Research, Inc.'s Empire language code, reduced mounds of paper and reports into a 60-slide presentation. "Graphics didn't totally replace numbers in the strategic plan, but it helped to see things instantaneously instead of going over spreadsheets."

Goldsmith may be the pied piper of graphics at FP&L, but Jose Luciani, in Divisions Planning and Administration, is surely one of its great champions. Luciani has been working

Goldsmith said the team spirit at FP&L is frequently bottom up. "Individuals get a lot of satisfaction from creating something that will really help out the company." Individual computer creativity can result in redundant keyboarding, especially when graphics use is high. FP&L has overcome the data entry duplication problem with the use of comprehensive shadow files. Records that come in through the field, bill processing, work orders or other means, are keyed by data entry personnel and stored as copies on four 3380 disk packs in Focus. These copies, or shadow files, are available to all users.

Since users do not have to concern themselves with many of the labor intensive tasks, their time is freed up, and they are able to learn and make use of sophisticated tools like graphics. "Sometimes you give the user just enough training to leave the horizons open. If you overtrain, you put blinders on the user. When you don't, you go back a couple of months later and see things the user has done alone that you would never have thought of yourself," Goldsmith said.

The user community at FP&L has responded very positively to graphics training. One employee who had been trained on the graphics package in a one-day class the previous week, created her own graph easily. The only problem she had was getting dropped once or twice from the dial-up line. Once the line held, she routed her graph to a Hewlett-Packard Co. plotter and had the finished product in a matter of minutes. "It was so easy," she enthused. "You can't believe what we had to go through when we did them by hand."

It was not always thus at FP&L. Nancy Klose is Manager of User Access Services and has been at FP&L for over 10 years. "Prior to 1981, when we had the Univac, we had an older graphics package called Zebra, which came from Emory University and was very programming-oriented. When we moved to the IBM environment, we decided that we had to update our tools so we selected Tell-A-Graf. It has really caught on very fast."

Klose is concerned that graphics has caught on a little too fast. FP&L has limited the

for years on his department's indicators book.

"We have certain indicators that we keep track of, data bases and on-line systems that are accessed to track and better manage our resources. This is particularly important to a utility because even though we have to service every customer, we must plan for what's coming. This year we were able to connect everyone in a reasonable amount of time," Luciani explained. Planning is critical to utilities since an unexpected and unplanned increase in services necessitates building new power plants, which are extremely expensive.

Graphics also helps track the cost per customer. "Top management wants the company to grow and the customers to be happy with the service we provide, but it is also important for investors to be satisfied with the amount of profit that they're making from their investments. Even though we are a monopoly, we do have to compete with other industries for monies from investors," Luciani said, adding that graphic presentation of such material to stockholders and potential investors can be a good selling tool.

Luciani is particularly pleased with the capabilities of the Tell-A-Graf package. He has even written execs, which call up one graph after another with one keystroke. Under VM/CMS, an exec is a group of procedures placed into a file. When the file is called up, each of the procedures executes automatically. "There's no front-end work involved, it's all driven by the execs. It actually goes to the data base, gets data and puts it into some coding that Tell-A-Graf understands," Luciani said. Because the book of indicators is so complete, and graphs can be called up on the screen so easily, viewing the graph with no hard copy required is often satisfactory.

The Economics department uses business graphics in order to do customer forecasts on the residential and commercial side. For residential customers, the department uses a model which includes household size and population in the census territory; to model commercial customers, variables include population and economic ratio. Graphs are also put into a book, which is produced once a year; information contained in the book allows FP&L to do energy forecasting with five- and 10-year projections for each classification.

Although traditional business graphics are the problems most in need of solving, FP&L has used graphics to service customers in a very special manner. Jim Fothergill, manager of Customer Systems, conducted a guided tour through their graphics system, which is IBM's Graphics Data Display Manager (GDDM), running on MVS under CICS Multi Region Option (MRO). They have built a model of the entire electrical distribution network from every substation to each of the 2.5 million customers in their service area. Every transformer, line switch, fuse and major component in the electrical distribution network was represented. The model enables FP&L to track the path the energy takes from the substation to every customer.

"As we have a problem in the network, we can analyse the probable cause of that problem based on the geographical location and how those customers are being served. We then can go to the lowest common component in the network that serves any particular group of customers that is out of service, and isolate that as the probable cause of the problem. Instead of sending a crew out to find the problem, as we used to do, now we send them to a specific location. From a graphics standpoint, we have every service territory broken up by boundaries, and we have every boundary broken up by every crew that works within that area. As a problem is isolated and found, we know exactly in the geographic location of that particular county or that township or that service territory where the problems are occurring, and we show that graphically on a CRT. Based on that we can then move crews around to flood an area that has more trouble than others, all in the name of better service," Fothergill explained.

Ed Baron of the Production Systems group added that as a

by-product, the system would also tell how many customers are affected by each device. "We can prioritize our calls based on the number of customers that are out of service, but we also have in this network every customer that is on life-sustaining medical equipment, like kidney dialysis machines or respirators, and we can accelerate service restoration to those customers. Anytime a problem is diagnosed that we know affects that customer, we will send somebody out immediately to make that repair." The system also can prioritize by catastrophic problems, so that a building fire takes precedence over somebody's lights flickering.

Fothergill added that the system is brand new and not yet fully implemented, although full implementation is scheduled for third-quarter 1985. "We felt that our customers deserved and needed this system because of the number of thunderstorms we have in the summertime, the potential for tropical storms or even hurricanes and the danger these storms pose for the large number of elderly people in our service area."

Information regarding trouble calls is brought up on various screens, but all this information translates to graphics in the form of maps showing all the trouble spots. There are division maps, two-hour total maps and division-status maps. In total, there are 400 miles of service territory, serving most of the populated area of Florida with the exception of Orlando, St. Petersburg and Tampa. The map is divided by major east/west and north/south natural boundaries (such as highways and rivers), which give some indication of location at any given time.

Baron demonstrated how the mapping system could work in a given test situation in which the map showed three problem areas. Two of these areas were assigned to the same crew. In a case like this, the dispatcher for the troubled area would communicate with the dispatcher for a contiguous area and arrange to have a crew from the second area cover one of the trouble spots in the first. In this way, routing and sequencing of trouble calls is done quickly and efficiently.

Another graph which is used frequently is called division status, a line graph which tracks continuity from midnight to present. A red line indicates new calls, a blue line denotes calls completed and a yellow line is reserved for active calls that have not been completed. Comparison of the three lines gives graphics representation on status: if the incoming (blue) calls are exceeding the completed (yellow) ones, the dispatcher's supervisor would most likely call a neighboring division and cover the area with new crews from other counties.

Before FP&L had this system, it took days longer to restore service. With the new system, crews are not sent out to the same problems over and over again; instead, the new system takes all the calls and reduces them to one trouble ticket.

Even the colors tell a story. When a ticket comes up that the dispatcher hasn't seen previously, it is red; once the dispatcher looks at it and sends it to another screen, it changes to yellow. When the problem is assigned to a crew, it turns green, but if further work is necessary by a service center, it then becomes blue. As a fail-safe, only dispatchers can enter information although any number of people can log on simultaneously in order to ascertain status.

But it is not always a disaster that shows up on the screens and maps. One trouble ticket on the actual production system noted a wire cut. That particular ticket belonged to a "current diversion" customer who was stealing electricity from the company. The worker to whom the ticket was assigned was to go to that location and actually cut the service, not at the meter but at the pole. Interestingly, one of the highlights of a large exhibit on display in the FP&L atrium was a number of examples of how some customers had employed rather sophisticated means to access electricity without paying for it. All were caught.

Graphics appeared to be the most used, most usable and most desirable feature in use at FP&L. But Klose was quick to add caveats. "Everybody in the company is not on Tell-A-Graf. We don't have that many graphics terminals out there yet, and that growth will be purposely slow because of the network impact." Klose said the company is looking at the departmental computer concept in order to offload graphics and lessen the impact on the mainframe, but she added that it would take a large computer to handle a graphics program as big as Iviss.

Whatever future direction FP&L chooses, there is no question that graphics will see greater use as time goes on. When an entire strategic plan for a company of this size can be reduced to a 60-slide presentation with supporting written documentation, word gets around.

And Goldsmith continues to preach the word. "Everybody from Personnel to Energy Management, Quality Improvement, Systems, Divisions Planning, power plants, the nuclear side, everybody and their brother is using this product. Sometimes the vendor walks into my office and says, 'What are you using for that?' not even recognizing his own product. We kind of stretch and sometimes break the envelope that the product was supposed to be."

White is senior writer at Computerworld Focus.

What's Best For Graphics – Mainframe Or Micros?

By Ellen M. Knapp

The introduction of personal computers in today's offices is bringing computing and computer graphics to more people than ever before. This does not mean that mainframe graphics will be left behind. The computing power we have come to rely on is more important now than ever before because of the challenge of increasing volumes of information to collect, manage and put to use. As the personal computer continues to offer more computing power, many of the sophisticated graphics applications that today work only on mainframes or minicomputers will eventually be available on the typical desktop computer. The IBM Personal Computer AT, introduced last year, is setting a new de facto standard for low-cost but powerful [illegible] systems and microcomputer-based graphics workstations.

It's no surprise that business graphics is one of the most dynamic areas of the computer graphics industry.

This growth, however, has not taken place in a vacuum. It is therefore important to understand the role and potential of business graphics within the context of other rapidly expanding capabilities, such as personal computers.

The recent significant increase in the use of personal computers is probably the [illegible] most important development affecting the use of graphics for business and management applications. Advances in semiconductor technology and better applications-oriented software tools have contributed to this increase, as has the fact that prices in the computer graphics market are about half what they were 18 months ago. Increasingly, functionality is being migrated first to the programmable read-only memory (Prom) level and then to the chip level, raising the potential rate of progress in the industry.

Graphics applications are being downloaded from mainframes as more intelligence and local graphics processing are being made available in desktop computers, workstations and intelligent terminals. Recent and current reductions in price and increases in performance of computing and memory resources are going to be key in supporting the widening range of required applications. The impact of 256K-byte memory chips and second-generation 16-bit microprocessors has already been felt, and great progress should accompany the widespread penetration of 32-bit microprocessors. The introduction of the personal computer has also had an impact on the cost of graphics peripherals; prices of digitizing tablets, plotters and film recorders are coming down.

Nevertheless, a critical need remains for mainframe computing power for large data base related, batch processing applications. In large companies, expenditures for mainframe software continue to be far greater than for either minicomputer or microcomputer software. In situations such as this, the desktop computers can be used either as stand-alone graphics tools with microcomputer software or as terminals providing lower-cost access to more sophisticated packages and large data sets resident in the host mainframe.

The division of labor between mainframes and micros may well parallel the division of graphics applications into high- and low-performance categories. Many presentation graphics applications require mainframe support either for the computing power required for special effects (including animation) or for access to large data sets that need to be translated into graphic images. Lower-level peer and personal graphics and applications that require smaller data sets fit the capabilities of a micro in a stand-alone mode.

Despite rosy predictions and innovations in the use of business graphics, certain problems remain. The biggest problem in migrating business graphics applications from mainframes to micros lies in the relative limitations of the personal computer. Other impediments to the successful implementation of business graphics include insufficient user knowledge, limited access to the system and its peripherals and less than complete integration of computer graphics with data bases and other information management systems.

Most of these problems will be resolved in time. A trend toward more interest in integrated software packages already exists. Vendors are recognizing that they have an obligation to their customers and their products to ensure that users are trained to access the entire set of available capabilities. As the cost of computing power and of input and output devices continues to decrease, limitations on access will be alleviated.

The solutions on the horizon seem to be approaching with amazing speed. Increased availability, including lower prices, will support the impact of the 32-bit machines in bringing mainframe-type graphics to the desktop. In the meantime, users and vendors can do a number of things to handle the present situation.

The software required to migrate graphics applications to micros can come from two obvious sources — current mainframe graphics suppliers and the growing number of micro software companies. Some of the established software vendors recognize that they face a major challenge. They would like to avoid redeveloping their entire line of mainframe software. One choice these vendors could make is to wait until the capabilities of the micro catch up with the requirements for running their graphics products. Vendors that make that choice are likely to face intense competition from software developers that are tailoring their new products directly to personal computers.

An alternative solution for current mainframe graphics software vendors is to provide products that help their customers in the interim. Integrated Software Systems Corp.'s IBM PC Graphics Interface is an example of a mainframe-to-micro link that enables the IBM Personal Computer to operate as a low-resolution graphics terminal in conjunction with almost any mainframe.

More than ever before, customer demand is playing a significant role in guiding vendor efforts in research and development. When computers and computer graphics were available only to a few select technical personnel, there was less variety in users' needs and requirements. Now, however, the typical user of computer graphics is anyone and everyone — from graphic artists to accountants to managers and professional staff. This variety is creating greater demand and better responses in the area of human factors engineering of computer systems. The use of icon-based interface systems, window-management software and English-language dialogues between the computer and the user are among the most visible methods currently used to improve the ease of access to mainframe and micro capabilities. Computer graphics developments play an important role in improving these and other types of user interfaces.

Not many simple statements can be made about migrating graphics applications from mainframes to micros. It has been done, it is being done today and it is working to varying degrees, depending on the particular situation — kinds of hardware and software used, applications already in place, new applications required, size of the applicable data bases and requirements for shared resources.

The companies that have been successful are those that have replicated their mainframe applications on the microcomputers while maintaining them on the mainframes. Some of the more successful companies have approached the problem with a two-step solution. As mainframes came down in price, these companies were able to place additional mainframes in individual departments rather than relying on only one centralized computer. The first step in the process of making graphics available to more users was to replicate the software on all of the departmental mainframes. The second step, which is a continuing process, is identifying capabilities for the personal computer that will put these same graphics facilities in the hands of an even greater number of users.

In the ideal world, of course, one software package or family of packages could run on all sizes of systems — mainframes, minis and micros. This kind of arrangement has particularly important benefits. With only one kind of software, only one kind of training is required. Technical support is also suddenly far easier to arrange and manage, and decisions about what devices to connect to the system are far easier to make. If rumors in the personal computer magazines are to be believed, IBM will soon release a product that could take us a long way toward that ideal world.

Yet, whether in the current world or in an ideal world, users planning for the migration of applications to different computer systems within a company should consider certain points. Obvious keys to success are planning, cooperation, communication, compatibility and flexibility. It would be wrong to underestimate the need for planning this aspect of automating an office, just as it would be foolhardy to buy 50 personal computers, install them and then figure out what you want to do with them. Bringing graphics applications to new levels of users is yet another case of introducing new resources into present work methods. Those who want to get the most out of those resources will find the first step is to establish and communicate clear plans on how the resources will be put to use.

Among the first decisions to be made when applications are migrated from a central computer to departmental mainframes will be who needs what kinds of information and which applications will be used to manage and display that information. One of the most important challenges of distributed processing is that we have not yet reached the point of having fully successful methods and mechanisms for distribution of data or of software among users. The various departments involved have to agree on such things as formats and methods for data collection, maintenance and exchange. This points to another important challenge — protecting the integrity of data in a distributed processing environment. In addition, someone has to be responsible for making sure all the equipment is compatible. Decisions also have to be made on how control of the system will be managed, whether by one centralized entity or separately by departments.

One of the most visible benefits of planning is protection against the potential chaos of ending up with a variety of stand-alone personal computers selected independently by various departments. Not only is there the potential for these personal computers to be incompatible, but other problems could result in the process of trying to migrate one kind of mainframe graphics to a variety of different desktop computers. The potential benefits of a network of compatible devices are still just around the corner as the industry continues its efforts to establish standards to make this fully functional. Planning for this kind of change is critical. Communication among the various players is equally important throughout the process, from planning through implementation and on into the future development and expansion of capabilities.

Many users who were introduced to graphics at the micro level now expect more in terms of graphics capabilities. They have done all that can be done on the micro and, in many cases, they have been exposed to more sophisticated capabilities. They want higher resolution, access to larger data bases, more power and more flexibility. On the one hand, their demands are a driving force behind advances in micro graphics development. On the other hand, some of these users won't wait for those advances and will turn to available 32-bit workstation systems and even to mainframe packages. This reverse migration is essentially another measure of the general demand for mainframe-quality graphics.

In recent years, the number of companies using business graphics has steadily increased. We can expect progress in the area of integrating business graphics with existing data bases and systems on the very near horizon. And just around the corner are advances that will help introduce greater numbers of people within organizations to the benefits and productivity improvements promised by business graphics. The migration of graphics applications from mainframes to micros is probably the most important of these advances, and the horizon is coming closer every day.

Knapp, a principal in the MIS division of the consulting firm, Booz, Allen and Hamilton, Inc. based in Bethesda, Md., is responsible for technical and management consulting in the areas of interactive computer graphics, human engineering and pattern recognition.

Implementing the Technology

By [illegible] Grover Rawlins

Graphics has had an interesting past. Initial efforts to standardize a set of graphics primitives for programmers were plagued with problems, and it's amazing we've come as far as we have. In those early days of graphics, the California Computer Products, Inc.'s (Calcomp) off-line plotter collected dust in the corner of the computer room because only one person knew how to use it. Graphics programmers from the old school could recite from memory the "X, Y, Ipen" commands that were the basis of most graphics software.

The technology of drawing pictures rather than listing columns of numbers on printers required a software interface from the application program. Hardware manufacturers (Calcomp and Tektronix, Inc., for example) found they had to supply existing software if they were to sell their hardware. The margins available to hardware manufacturers meant that the engineering effort for the supporting software was nowhere near what it would be for the hardware.

The capabilities of these original graphics devices (erase the page, move, draw, change color or pen) were relatively simplistic. Nevertheless, efforts to produce software of a higher quality and functionality began in earnest, in universities and graduate schools, government defense agencies and the private sector. The software that emerged, whatever its source, had one characteristic: It was highly idiosyncratic.

Every routine to draw an axis was different, as was every command to change the line style and every method for drawing text. Software suppliers started to call their libraries "graphic languages" because of the specifics associated with each graphics subroutine library. The skills for using the software were so specific that it wasn't uncommon for recruiting advertisements to ask for "programmers with three years of experience using Disspla." Professional software companies had made an inordinate effort and investment in writing, supplying and debugging proprietary code. The last thing they wanted was for a generic graphics standard to be available. Such a standard would undermine proprietary products and would offer a clear and inexpensive alternative for users who wanted the mystique removed from the graphics area. The first barrier to an endorsement by the graphics community of a highly functional graphics standard was that sales of existing proprietary software packages would be impacted and invested dollar lost.

In the U.S., the force behind many efforts to define a graphics standard came from academicians, who had access to powerful computers and were not fully aware of the impact of implementation concerns. These academicians set about to define a set of robust concepts and functions that could be the underpinnings of all future applications. However, a standardization process can take up to 10 years. The slow-moving standardization effort often fails to keep pace with fast moving technology, especially when the life cycle of that technology can be as short as three years, as was the case with the Graphics Kernel System (GKS)

and its associated standards. Regardless of how hard the promoters pushed graphics standards, the technology was going to have a significant impact on their efforts; this problem was the second barrier.

As more hardware and software manufacturers got involved in the standardization process and the direction became more focused, it became clear that a standard would not be a standard unless it became an implemented international standard. The international standardization effort was parallel to the U.S. effort, but not on a one-to-one correspondence. The international standards efforts defined a graphics model that was superior to the one proposed to the U.S. While Europe was defining the GKS, the U.S. was struggling with Core. Politics finally raised its head. The Association for Computer Machinery (ACM) Special Interest Group on Graphics (Siggraph) as well as some software manufacturers were supporting the Core proposal and trying to have the American National Standards Institute (Ansi) adopt this proposal. It soon became evident that the progress of the Europeans to standardize GKS coupled with its superior design were going to make acceptance of the Core proposal difficult. This politicking was an important process in the standardization effort, but it had an unfortunate result: It slowed the process and continued to allow the definitions of technology that would make the implementation of GKS even more difficult. When GKS was initially considered, the concept of an IBM Personal Computer or Unix-based workstation never existed. How could a standard growing out of the IBM 370 era be viable on an Intel Corp. 8086 or even a Motorola, Inc. 68000? Another barrier had been created by technological enhancements!

When the Ansi committee decided to drop its efforts to propose Core as the standard and in turn accepted GKS as the most viable graphics model, some software developers and special interest groups clouded the issue by continuing to try to force Core as the new de facto standard. Core-based software packages still exist, but for all practical purposes Core is just another nonstandard implementation of graphics routines.

Today, many GKS libraries are advertised in the technical journals and, more important, commercial applications are being written on top of this recently emerging standard.

Many areas of graphics have had their separate standardization efforts. Just as there is no such thing as the ultimate compiler, there is no such thing as the ultimate graphics standard. Both the international and the national standard communities are therefore proposing modular graphics standards based on singular functionality.

For example, one might want to transfer machine-part definitions from one computing system to another. The Initial Graphic Exchange Standard (Iges) could be considered in this instance. If one wanted to draw this machine part using very high-level graphics concepts called primitives, GKS could be used. If device independence were a major issue, GKS might invoke a virtual device interface (VDI) routine.

If this graphic image of a machine part were to be transferred across phone lines, a North American Presentation Level Protocol Syntax (Naplps) device driver might be used. And if, instead of sending this image across phone lines, the engineer wanted to save it for future reference, a Virtual Device Metafile (VDM) might be considered.

As can be seen, different aspects of an application could draw upon different graphic tools. Because of the singularity of many of these tools, the standards community is trying to separately define the functionality and to promote them as standards. The overall application might then be put together along the lines of the construction of a stereo system from components.

However, many things look good on paper but never fly. The implementation concerns of creating a viable GKS subroutine library is more involved than just writing routines that match the calling sequences found in the

standards document. An extreme example is a very sloppy implementation running on a Cray I mainframe. That same implementation would be totally unacceptable on a 16-bit microcomputer. In the first case, machine power and memory is of no concern, but in the second it is a major bottleneck. Just how a software manufacturer implements GKS is dependent upon the targeted environment. If the two primary problems are speed and size, a number of suggestions can help guarantee a successful implementation.

All graphics, including GKS, require heavy use of mathematics. The mathematics of graphical transformations needs to be in floating-point notation. The graphics to be drawn exists in world coordinates. This image, whether a machine part or a bar chart, could be scaled, translated or rotated. Trigonometry can take a terrible toll on machines that have slow floating-point arithmetic.

Graphics applications require significant resources on the part of both the computer and the programmer.

One technique employed to bypass this bottleneck is the use of fractional integers. Fractional integers represent floating-point numbers in a format that allows integer mathematics to produce the same output produced with floating-point mathematics. The enhancement of this technique rests in machines that do not have floating point hardware support. As more machines have coprocessors or supplemental circuitry to enhance floating-point arithmetic, software manufacturers will use this technique less. Designers who have used this implementation will have to remove their code if their customers are not to be penalized as they advance to better machines.

Another mechanism that increases execution speed is the use of look-up tables instead of mathematical series approximations. Segmentation manipulations found in higher levels of GKS can require significant matrix multiplication in order to rotate or otherwise manipulate an object. Trigonometric functions such as sine and cosine are normally implemented as a series of mathematical calculations that approximate the correct value. To get around this, look-up tables can be considered. What might be gained in speed, however, can be lost in memory.

Graphics manipulation can require significant mathematics. A concept called clipping is one of them.

Graphics entities that extend past a barrier need to be clipped off or mathematically removed. In GKS, multiple areas require clipping. Some implementors combine or merge the clipping rectangles into one rather than clipping graphics entities serially. More initial effort is required, but after the merged clipping window has been defined, the graphical elements can be examined and clipped much faster. The common thread that runs through the above tricks is the implementation of a significant tool on a machine that physically cannot adequately support the software. Microcomputers and the sophistication and power of GKS may very well not be suited for each other. Professional decision support or engineering graphics that requires machine and device independence also requires substantial horsepower. Many people question the viability of having an 8086 engine. The second area of implementation concerns size. Computer memory (or the lack of it) has always been a plague. The primary law of software functionality states that the more memory consumed by the supporting routines, the less there is for the application. Professional graphics applications do require memory. They require significant resources, on the part of both the computer and the programmer.

Many things can be considered to cut down memory requirements. The first is limiting the size of device drivers. The device driver is a module of code that takes somewhat generic graphics commands and converts them to a series of bits that can be understood by the actual output device. The more intelligence built into a device, the smaller the device driver.

The older software manufacturers who have the 1970-based "X ,Y, lpen" technology imbedded in their first generation products find it difficult to adapt to the more intelligent equipment. Today, the graphics information that needs to be communicated to the device can be of a much higher concept. No longer is a circle defined as a series of straight vectors that constantly turn in on themselves so that a closed loop is finally visualized. One can now communicate to the device the message that "I want to draw a circle with this radius and that center point." Less data is required to define the graphics element and in many cases it is drawn magnitudes faster.

Because the attached displays found on microcomputers have very little intelligence, it is not unusual to find device drivers that exceed 20,000 bytes. On the other hand, detached displays normally found on Unix-based machines have a much higher intelligence. In the latter equipment, a device driver exceeding 5,000 bytes would be surprising.

Microcomputer software manufacturers counteract the problem of large device drivers by dynamically loading and unloading the driver. This has the benefit of making resident only the device driver that is going to be immediately used. In many circumstances, the overhead in communicating with this dynamic driver will slow down the system.

Interprocess communication found in Unix can communicate from the main application to a second process running the device driver. Interprocess communication can in itself require tremendous resources. The gain in memory conservation is counterbalanced by a loss in overall throughput. Software products that have implemented small device drivers have a clear advantage. The drivers can be linked in line with the main application with little or no concern for size constraints and with no speed degradation due to multiple processes vying for the processor.

Perhaps the best memory management scheme comes from the use of the language C. When used to create a GKS library, C can make special memory management tools available to the graphics modules. These tools allow different areas of the application to use the same block of memory for data storage. This capability is unfortunately not available to GKS libraries written in Fortran. GKS implementations stemming from machines with proprietary operating systems are quite often written in Fortran.

C offers more than just memory management tools; it produces very compact code. In addition, C's portability across Unix systems gives the porting of a GKS library great ease. It was not unusual in the days of mainframe proprietary graphics software packages to take six months to adapt to a new environment. Today, Unix-based GKS written in C can be moved easily from machine to machine with no more effort than it takes to compile and link a library.

The last area of concern for memory management lies in the manipulation of segments. Segments are graphics objects that can be treated as a single unit. They might be made of text, simple vectors or more advanced primitives. They can be manipulated as one unit, not as a series of single entities. A number of applications that require segmentation require a significant amount of segmentation. To maintain the initial definition of a segmentation and then make multiple copies on the workstation requires that this information be saved and reused. Some software manufacturers are creating specialized data manipulation regimens that will off-load large amounts of data to disk in a manner similar to the way a virtual operating system works. This ability to

Perhaps the best memory management scheme comes from the use of the language C.

automatically save segments frees the application writer of many programming concerns. Again, throughput will be affected. As more and more intelligent hardware devices supply their own internal segmentation capabilities, segment storage and manipulation can be done locally on the display device rather than in the main processor.

An event is about to happen — the marriage between GKS and the Unix operating system. Unix is designed not only to be processor independent, but also to allow for portable applications. An application running on a small Unix workstation can run without modification on a Amdahl Corp. computer also running Unix. GKS has the same design criteria and is designed to allow applications written using a standard implementation of GKS to run unmodified on any machine. As GKS can take advantage of the machine and processor independence of an operating system like Unix, a true marriage will take place. A subroutine library designed to accept machine-independent and device-independent source routines sitting on top of an operating system that masks the particularities of the processor and other machine constraints will make GKS the truly international standard that by all rights it deserves to be.

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Visual Information Systems: New Hope For Decision Makers

By Mark Borgmann

If you had a nickel for every hour employees analyze printouts produced by your corporate data processing department, you'd probably be very wealthy. What is the hourly cost when a person analyzes these printouts? And what's the object of all that analysis? Is the employee looking for just one or two numbers, adding some numbers together or trying to identify relationships between columns or rows? Whatever the object, the printouts are actually being used as data. The data on the printouts needs further manual processing before it becomes information — the meaningful kernel that can stand alone.

What's happening? We in DP thought we were providing information. We're supposed to use data, not generate it. Executives have better things to do than trying to second-guess the computer wizards in DP's ivory towers. Aren't DPers paid to meet the executive's information needs, anyway?

Can we honestly say today that DP produces the information the corporation needs? Rarely. It's a Herculean task to analyze the boxes of printouts produced on a daily basis. We've developed many new technologies to enhance data input and processing, but we've overlooked the [illegible] component — output. [illegible] rapid [illegible] of [illegible] minute.

Visual [illegible] systems (VIS), the next [illegible] the computer-based graphics arena, offers hope for [illegible] decision makers. It also offers the potential for the wizards to redeem themselves and reclaim some long-lost organizational respect, credibility and perceived value.

A VIS is an application that allows executives to monitor the current state of various kinds of corporate information (financial, performance, personnel or project-related). A VIS offers access through one or two keys to meaningful charts that can be easily and quickly digested. These charts are often presented in a hierarchical [illegible].

[illegible] a VIS might provide [illegible] charts at various levels [illegible], regional, [illegible] plant and building. Most of [illegible] charts are never seen and come into play only when hints of a problem arise in one of the high-level charts. The low-level charts allow the executive to identify the cause of the problem and take corrective action. Most of these applications are fed directly from actual corporate data (the same data that generates all those printouts). Notes that tell how current the data is, where it came from and whom to contact for more information are available for each chart by touching another key. This is information an executive can use immediately with no additional processing.

Because VIS charts have generic titles and annotations, executives must be able to change chart features to highlight problem areas. For example, a title might be changed from "Product B Sales Performance" to "Product B Sales Are Falling." After changes are made, another keystroke allows the user to produce a high-quality hard copy, transparency or 35mm slide in support of his posi-

tion or for use in strategic planning sessions designed to correct the situation.

To be successful, a VIS must become a widely accepted and relied-upon corporate information tool. You must make the system a familiar and indispensable part of the managerial environment. No better, more visible way exists for a DP shop that views itself as a service organization to serve its company. If

Ambiguity in VIS charts is simply not acceptable.

your DP shop doesn't view itself as a service organization and see information processing as its role, perhaps some probing questions are in order.

As with any application, a VIS must be tailored to meet the specific needs and constraints of an organization. Although some variation exists in component selections, at the generic level, a VIS should consist of the following:

- Continuous corporate backing and commitment.
- VIS users.
- VIS support consultants.
- VIS support methods and procedures.
- CPU.
- Data bases.
- Input devices.
- Output devices.
- VIS software.

Management backing and commitment are the most critical parts of a VIS. When the system is working, most people love it. But all the "attaboys" your VIS may have earned can be wiped out by just one voice with the right authority. You must continually work to deserve and preserve your backing, and the more you've made your VIS an integrated indispensable management tool, the better your system's chances will be of weathering the occasional storms. If the system meets your clients' expectations, your backing should remain intact.

VIS clients (and they don't appreciate being referred to as end users) are the people who determine whether your system will succeed or fail. A VIS is designed to meet their information needs as they define them. Contrary to some people's thinking, VIS clients will not accept "Merlin management" decisions. VIS clients expect the VIS to be:

- Reliable (and always available when needed).
- Predictable (so it will operate the same way every time).
- Quick to use.
- Easy to use (one- or two-key access).
- Even simpler to learn (preferably no training at all).
- Easy to understand.
- Equipped with meaningful, up-to-date information.
- Able to meet output quality requirements.

Criticisms of VIS clients include "They don't understand what's involved," or "They want it when?" The old adage, "Nothing's impossible to the man who doesn't have to do it himself," applies here. The VIS targets and was designed for just such a man — and woman. VIS clients interact with the VIS to monitor business functions and to identify and solve business problems. It is strictly a tool to help those people carry out their daily responsibilities more effectively. If it isn't a reliable and effective tool, it won't be used. The requirements are not easily met or sustained, but they are well worth the effort to your company.

VIS output must be easily understood. Ambiguity in VIS charts is simply not acceptable. In addition, these clients will not appreciate being insulted by a chart they can't understand. The Kiss rule — Keep it simple, stupid! — is applicable here. A chart can raise questions, but they should be something like "Why aren't we meeting our sales commitments," not "What does this green line near the top of the chart mean?"

Rather than appear ignorant

by asking the latter kind of question, clients will just stop using the system.

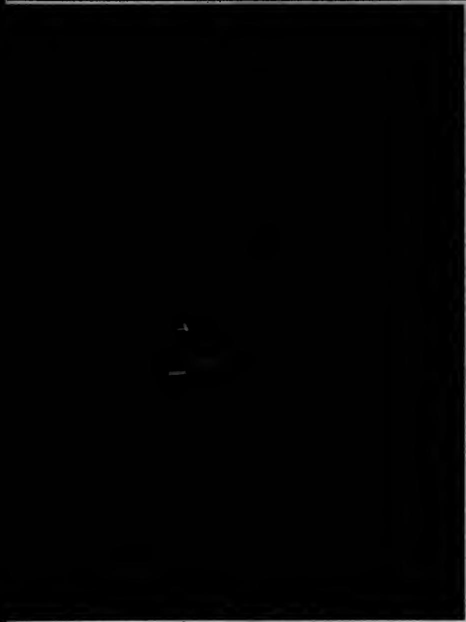
To make the system work, VIS support consultants will be needed. These people are responsible for the day-to-day care and feeding of the system. Among their responsibilities are the following:

- Creating new chart layouts.
- Setting up data base linkages.
- Interviewing clients and assessing their needs.
- Implementing changes in the system.
- Maintaining system components.
- Researching and developing functions to identify further needs and system enhancements.

The most important task these people perform is to maintain their perspective on the client's role in the VIS. Each support person must remember the VIS is there for the client and — even if it is sometimes difficult — must resist the urge to be defensive.

Friendly, cooperative client-consultant relationships are essential. Support consultants must be people-oriented and able to adapt their personality and delivery as necessary to communicate effectively with all levels of the corporation.

To be effective, consultants must understand the clients' needs and responsibilities. The qualities of a renaissance man would be ideal. Your support staff must not only have the necessary technical skills, but also must be familiar with corporate structure and functional operations. They must ease the clients' transition to visual thought and decision-making.



What are the necessary technical skills? They will vary, depending on the VIS implementation. Some areas of skill will be needed only occasionally; others will be part of the support consultant staffing requirements. Applications experts will be needed to help establish appropriate linkages to corporate data bases. Other technical skills to

Each support person must remember the VIS is there for the client.

be represented are the following:

- Data base administrators.
- Data communications specialists.
- Graphic artists.
- Graphics software specialists.
- Graphics hardware experts.
- Human factors (client interface, documentation and workstations).
- Systems software specialists.

Most problems that arise in this area will result from forgetting the client's role or from poor intergroup communications.

The rules your support consultants will live by are your VIS support methods and procedures. Accepted procedures are necessary to ensure that clients are responded to in a timely fashion and that nothing falls through the cracks. Procedures should ensure that system maintenance will have no adverse impact on the clients. These procedures also define responsibilities and policies to be followed for:

- Client contacts and responses.
- Controlling work flow in the support group.
- Follow-up client audits.
- Problem tracking and resolution.
- Requests for changes or additions to chart libraries.
- System enhancements.
- System maintenance.
- System testing.

One important policy you should insist upon is that all system maintenance will be conducted during off shifts and will

be fully tested before actual implementation takes place. Do not neglect this important system component. Well-conceived and enforced rules for VIS operation and support are essential if clients' expectations are to be met.

The VIS will need a processing unit, and CPU selection will depend on the type, location and volume of data; the number of clients using the system simultaneously; the anticipated future system expansion; the desired system response time and reliability; your output requirements; and the quality threshold of your clients.

The CPU and its operating system should be able to support batch processing for updating the chart libraries and data bases associated with the VIS. Creating charts during VIS viewing sessions takes longer than most clients are willing to wait. If charts are created and stored in a batch process, clients can play back individual chart selections as they need to view them. The display process takes only a fraction of the time needed to create and store the charts.

Data bases are the driving force behind visual information systems. The biggest considerations here are data base-to-VIS linkages and data currency. If you cannot (or will not) provide access to the data, don't even consider offering a VIS to your clients. You would just be wasting their time and yours.

Software for data base linkages exists in the commercial marketplace, or you can write your own. The key point to remember is that the linkage software should allow enough flexibility to be used for most if not all data base linkages. This allows quick response to changing demands for information and requests for new charts in the VIS libraries.

Again, if clients are to find the VIS useful, the data must constantly be refreshed as it is updated. Refresh cycles don't necessarily have to mirror the frequency of updates to the data base. Often, off-shift computer time can be used for updates. If decisions require the most current data, however, make sure the VIS has the new chart with each update.

If you cannot provide access to the data, don't even consider offering a VIS.

VIS input devices allow clients to control their access to the system. The input devices should be tailored to the needs of the individual client as much as possible. For example, some clients don't mind typing on a keyboard. Others who believe typing isn't their function or strength might prefer a joystick, two buttons instead of a keyboard or, in true executive fashion, just pointing at the desired item on the screen. Your system should provide some flexibility for input devices while retaining the full functionality of the system.

VIS output devices fall into one of two categories: soft-copy or hard-copy devices. Soft-copy devices are the terminals VIS clients use to view their charts. Clients should have their own viewing screens in their offices, and color devices are usually preferred. These individual screens eliminate many problems for the clients, not the least of which is being out of the office when trouble rears its ugly head. Select devices for their compatibility with your system as well as for performance and fit into the client's work environment. Projection systems that display images on large screens also qualify as soft-copy devices.

Hard-copy devices give you something to take with you: a piece of paper, a viewgraph or a 35mm slide. For example, hard copy of charts is useful in presenting results or status to associates or as an aid in correcting problems.

Hard-copy devices should be shared, for the following reasons:

- Client needn't worry about how to use output devices.
- Client needn't bother with supplies, ink, toner and film.
- Capital outlays for output devices are lower.
- Shared devices can be better maintained.
- Higher quality devices can be easily cost-justified.
- Client terminal isn't locked out while waiting for hard copy; client can continue with other functions.

One of the most important attributes of VIS software should be device independence.

In a shared environment, many devices can be used, including black-and-white and color laser printers, pen plotters, color ink-jet printers, dot matrix printers, color thermal printers, electroerosion printers and film recorders.

Many of these devices will require some kind of vector-to-raster conversion, which involves taking a linear image and converting it to a dot-matrix form for display on the device. Special hardware rasterizers are available to do this conversion; host CPU software can also be utilized.

You will need to evaluate the expense and efficiency of each alternative relative to the number of physical hard-copy devices planned for your system.

IBM installations are slightly more involved when it comes to most of the above hard-copy devices. The overwhelming majority of these devices utilize an asynchronous Ascii communications protocol. To use these devices in IBM shops you must convert either Systems Network Architecture or bisynchronous protocols to Ascii. Several vendors make effective, low-cost protocol converters for this purpose.

The VIS software delivers all this to the client in a neat, easy-to-use package. It controls all client interaction with the chart libraries, library update functions, chart security, chart viewing and all hard-copy production while protecting the client from everything else.

One of the most important attributes of VIS software should be what is commonly referred to as device independence. Device independence means a system should be able to support not just one but many different types of output devices. More than half of the 20-plus device types we support were not available five years ago. Device independence lets your system keep pace with the rapid technological advances of the computer graphics industry.

The client interface should be easily understood and should have Help functions available at any point during a session. These qualities will let the client become self-sufficient and also reduce support and training. Try to make your system simple to use so formal training will be unnecessary.

If several graphics software products are used in the company, the system should be capable of displaying information from all products during the VIS session. This could include such diverse information as thematic maps, product design specifications, logos, business graphics, art, document images and electronic schematic diagrams.

By now you're probably wondering how anyone could have such a utopian view. The fact is that VIS technologies are rapidly reaching performance levels executives have demanded in vain for years.

Will VIS fulfill every executive's information dreams? If your DP organization is up to the challenge, the answer this time may well be yes.

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Who Copes With The Graphics Deluge?

By Betsy Riley

Much has been written about the hardware and software planning necessary for successful computer graphics projects. Frequently overlooked, however, is the area of human relations. Because no purchasing decisions are made in that area, it is often not considered a potential problem and so no planning is done. Many organizations find this is a big mistake and discover several areas where human relations problems can make or break a computer graphics project.

The first problem that can arise is where to place the computer graphics function in the organization. That sounds simple, but can turn into a major political struggle. The problem in many companies is that these groups have grown up separately. Computer graphics came after graphics and computers already existed. In very few places are these groups anywhere close to the same part of the organization. The result is two groups, each with a vested interest in these new techniques, often in totally separate parts of the organization. Nobody wants to give up any turf, but both groups need to communicate and work together. The programmers have to recognize that the field of graphics has been around for a long time and that the experts in that field are the people in the graphic arts departments. On the other hand, the artists have to recognize that they are no longer going to be the only ones doing graphics. The tools are there, particularly with chartbook systems which offer predesigned graphics. These systems will let managers, secretaries, clerks or scientists do some graphics on their own.

There are after all two basic functions being provided: the systems function (providing software and so on that works) and the service function (providing graphics for customers).

In many organizations these functions are separated (with the systems function in the computer department and the service function in the art department). This can work very well if proper communication is established so the groups can work together.

Suppose a decision is made to keep the systems functions in the computing department and place the service function in the art department. Everything should be fine, right? Wrong. The biggest problem we had was introducing computer graphics into the graphic arts department. Most of the problems were created by programmers' mistakes. We have identified five causes of problems we had in the course of the project:

• Jargon differences created a communications barrier. Computer science is full of violent sounding terminology. The illustrators (like any users unfamiliar with computers) were somewhat wary of the system and afraid that dire consequences would ensue if they pushed the wrong button. There they sat in the terminal room moving a cursor around, having just been warned that the operator would kill them if they were quiet too long. We reassured them that "The worst that can happen is that your job will bomb. But don't worry, after you crash and burn a few times you'll get the hang of it." That was just the beginning. We realized we shouldn't use abbreviations (for example, .GE. for greater than or equal to) after one illustrator asked what, "General Electric zero" meant. Another term — defaulting — was discovered to be jargon. A prominent feature of our front-end software is defaulting to preset values when arguments were skipped. On checking with the illustrators, we found that they had not been taking advantage of this feature. Reading the dictionary definition of "default" had caused them to interpret the description of a special feature as a warning of a potential problem. However, jargon was not the only communication problem.

• Unintentional insults were frequent because of each group's ignorance of the other. Again the programmers were the main

offenders. In promoting computer graphics to those outside of graphic arts, we often stressed the superiority of computer graphics over visuals done by hand. This argument was valid for researchers and managers, who usually had no artistic training. However, the same presentation was a slap in the face to illustrators who did all of their work by hand. A less serious offense was referring to all members of the graphic arts department as artists. The terms artist, illustrator and designer had job-level connotations, and a senior designer was not pleased to be introduced as a graphic artist. Problems were created not only by things that were done, but also from things that were not done.

• Ignoring the fears and prejudices of the illustrators caused those feelings to grow. The introduction of a computer to perform tasks formerly done solely by manual methods will cause concerns for job security in almost any profession, and the graphic arts department was no exception. In addition to being afraid they would lose their jobs, some members worried they would lose the job level they had attained through years of hard work and training. There was also the fear that everyone would be forced to use computer graphics. That fear was especially strong among those who had chosen design as a career because they disliked mathematics and other similar sciences.

• Overselling of computer graphics fueled these fears and caused resentment. Be aware of praising the software too highly, claiming that computer graphics can do anything and that anyone can use computer graphics because it is so easy. Riding into the graphic arts department on a white horse waving the banner of computer graphics and expecting to be welcomed with open arms is a mistake. A new system may seem easy in comparison to old software, but the new system is not all that easy. As one illustrator said, "It's not easy. It's hard, but it's worth it." The claims that computer graphics could do anything arose from another cause, the last problem we discovered.

• Computer scientists have not been trained to recognize presentation- and publication-quality graphics. Too often in computer graphics (especially graphics produced by programmers) the medium was the message. We had not learned moderation. We had not realised that the audience should not notice the slides, but rather the information on the slides. We were like children with their first boxes of paints — too enthralled in splashing colors around to worry what the final product looked like.

Identifying all these problems was a learning experience. In retrospect, we identified necessary actions for establishing good relations in a project of this type. (This is fortunate for us because there are still other graphic arts departments within Martin Marietta Energy Systems, Inc. that have not yet added computer graphics to their services.) We eventually took all of the following actions, but we might have taken them sooner if we had identified them as potential problems from the beginning:

• Identified jargon so it could be explained or removed. We did this by consulting a technical editor unfamiliar with graphics or computer terminology.

• Found someone in the graphic arts department with whom we could have an egoless discussion to determine our areas of ignorance.

• Identified the fears and prejudices that existed and set up an open forum to discuss them. Management did much to relieve the fears, especially by pointing out that the graphic arts department was not converting to computer graphics, but merely adding it as a new service.

• Realized the limitations of computer graphics. Because of the effort involved, some things just weren't worth doing. And because of software and hardware limitations, some things couldn't be done.

• Tapped the resources of the graphic arts department (and of photography and reproduction) to learn publication- and presentation-quality requirements.

Following the steps we took can get you in the door more smoothly. However, if you do split the system and service functions organizationally, you will have to work at keeping communications open. Here are some techniques we used:

• Hold regular formal interface meetings between the two groups (with top management included) to discuss goals and needs and to develop timetables for meeting them.

• Have frequent informal meetings (for example, drop by to ask if there are any problems).

• Trade people occasionally (for example, sit in with the other group for a day to see what their work load and daily problems are like).

• Establish an automatic exchange of schedule information (for example, programmers notify artists in advance about any changes to the system; artists notify programmers of any scheduled rush or critical jobs).

Many other decisions need to be made in the course of establishing a computer graphics function and over the life of a project (for example, open vs. closed shop and what level of service to provide). Just remember that there is more to computer graphics than the hardware and software. Careful consideration of potential human relations problems can help make your project a success. ‡

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KEVIN CONKLIN

Bringing In-House Publishing Up To Date

By Bernard Peuto

Most chief executive officers who are asked how much the company is spending on telecommunications hardware and services will recite a figure for capital equipment expenditures. Asked how much the company is spending each year on printed documents — newsletters, forms, sales manuals, training manuals, price lists and, particularly, engineering documentation — these same CEOs will probably draw a blank.

This situation typifies the problems most U.S. companies' publications departments face today. More than 80,000 domestic firms currently produce documents in-house under the administration of technical documentation, publications or graphic arts managers. The average company is a division of a Fortune 2000 firm with divisional revenues of $50 million to $100 million. This company is probably spending between 1% and 3.5% of its annual sales on printed materials, generally well in excess of $1 million annually, according to some studies. In high-technology-based industries such as software, communications, aerospace and health care, the level of complexity for most documentation is extremely high.

The document creation process is often dated, serial in work flow, labor-intensive and extremely cumbersome. The serious loss of productivity, rampant inaccuracies and drain on expenses that result is a situation that most corporate management has not, as yet, acknowledged. The prob-

lem is multifaceted and begins with management's perceptions of technical documentation. In many ways, documentation has been viewed as an undesirable but necessary offspring of research and development. Products are often referred to as document-dependent and, although in most cases the documentation is not the company's primary product, it plays a critical role in the R&D and manufacturing phases. Moreover, a company's ability to produce high-quality accurate user support materials when the product is on the market is increasingly being linked to a company's competitive edge. Poor performance and product recalls are commonly traced to faulty documentation.

Savings can be anywhere from $25 to $300 per page using a computer-aided publishing system. A company that produces 2,000 to 5,000 pages annually, as most companies do, can find the savings staggering.

Since specialized computer-aided design (CAD) and computer-aided engineering (CAE) systems have become established fixtures in the engineering and design phases, product development phases have been reduced to fractions of the man-hours once required. However, because typewriters or word processors are the sole support for most technical editors, writers and illustrators, the document related to the product may take dramatically longer to create — and have considerably more errors — than the product itself.

Traditionally, those creating the documentation have little understanding of engineering specifications. Skills in writing, paste-up and illustration are emphasized more than technical accuracy. Therefore, errors are difficult to spot immediately and are easily introduced into the later stages of the publishing process.

As errors slip into the early stages of the publications process, corrections become a nightmare to reverse. Individuals must make their contribution to a project at specific steps: the writer finishes writing and forwards the project to the graphic artist, and it is then forwarded to be typeset and, finally, boards are pasted up. Illustrations represent still another step.

When corrections must be introduced, they constitute almost a complete reversal of the step-by-step process; worse still, corrections are usually not localized. A correction on one portion of the page can easily affect the entire page or even the entire document, which may run hundreds of pages. Due to their very nature and the various skill groups required, these changes cannot be made in any timely fashion. A simple correction in text, for example, can require hours or days to correct and then may be kicked back again for another correction in the illustration. Errors are not the only changes that are introduced. Often, while the document is being created, the product is being enhanced; faults in design are corrected, and immediate revisions to the documentation are required.

The problems of in-plant publishing are not new. In-plant publishing is an age-old problem that has been ineffectively addressed in the past.

Several manufacturers introduced a range of hardware aimed at automating specific tasks in the publications process: WP for the writer, specialized graphics systems for the artist and computerized typesetting machines for the typographer. This localized automation meant that skill groups and their machines remained isolated and, in effect, the step-by-step publishing process remained intact. With relatively few standards among manufacturers, hardware purchasing becomes an investment decision offering a limited return under these conditions. In short, the publications manager trades a human problem for an electronic problem.

Among the recent reports that indicate the computer-aided publishing (CAP) market is poised for explosive growth in the years ahead is one from Frost & Sullivan, Inc., which expects the total amount of CAP hardware sold from 1985 to 1988 to reach $9 billion. This market projection includes the total CAP market: service bureaus, in-plant technical publishing, ad agencies, books, newspapers and magazines. The demand for in-plant technical publishing hardware is by far the fastest growing of these various market segments.

It is clear that users want more than a partial or localized solution. However, it was crucial for CAP system manufacturers to understand the importance of integration in order to best approach the user with a total solution.

From the publication manager's point of view, integration is characterized by three important points:

• Most managers need integration of text, graphics and composition on one system that offers users "editable-what-you-see-is-what-you-get." This allows anyone in the publications department to view, adjust and manipulate any combination of text and graphics from any workstation, on any page and at any stage of a publication's development cycle. This CAP system capability means documents are not locked into the serial steps of the publishing process. They can be viewed and manipulated at any time, and changes can be made instantly at any point in the publishing process.

Writers, for example, can enter text at a workstation and view it in typeset form, composed on the page as it will appear in the completed document. Heads, subheads and body copy will appear in the correct typeface and point size. Indexes and tables of contents are generated automatically as the writer develops new chapters, sections and subsections. In addition, because form and content are independent, the writer has the option to change the appearance of a page at any time by selecting new properties such as typefaces or number of columns.

Illustrators can scan images, use a graphics puck on certain CAP systems to draw freehand or select symbols from a variety of graphics palettes. As a result, illustrators can create line art including schematics, flow charts and timing diagrams. Designers, typesetters and production people might enter specifications on a style sheet, and the CAP system will completely reformat an entire document when this style sheet is applied. When a document is paginated, page breaks, graphics positioning, headers, footnotes and other elements of the final piece are handled automatically.

Because each document is created in camera-ready form, reviewers see each page fully composed in final form. Text, graphics, captions, footnotes and all the other elements appear just where they would in the final pass.


CAP system lets users see pages and make changes on the screen.

• Integration of the various skill groups on the CAP system working within the publications department has a favorable impact on the publishing process in several important ways.

The traditional one-step-at-a-time or serial production process that inflexibly caused projects to move in a rigid progression from one skill group to the next (for example, from writers to illustrators to production) is eliminated. Instead, this fragmented process is replaced by a system that joins all the players into a unified team — all the publications professionals bring their skills to the project at the same time or in parallel. As a result, the time needed to bring the project to camera-ready art is dramatically reduced. This in turn greatly reduces the cost of the publishing project on a per-page basis.

Because of the independence of content and form, type changes, for example, can be made to the form without any impact on content. Revisions or last-minute modifications to the project no longer cause a ripple effect throughout the entire document. Also, fewer users become involved in the revision process with a corresponding decrease in the likelihood of new errors being introduced through a revision.

• The integration of input/output sources is crucial. A substantial capital investment usually exists in WP systems, personal computers, in-house phototypesetters and similar devices that are used to create corporate documents. The system should be designed to work with this equipment, rather than making these devices obsolete or ignoring them. Ideally, the CAP system's user interface should be modeled after the traditional publications organization. Users should be able to operate the system using plain English rather than special typographical markup codes or computer programming commands.

Similar to the management control factor that is the impetus behind many forms of today's office automation technologies, CAP systems also offer management the opportunity to oversee in-plant publishing with a degree of control over a typically unruly process.

The publications manager is better equipped to monitor time, costs and materials on a per-project basis. Delays due to approvals, revisions, errors or modifications can be tracked. Managers are better able to handle a greater number of projects and to work toward multiple deadlines without the fear of bottlenecking as several projects near a completion date simultaneously.

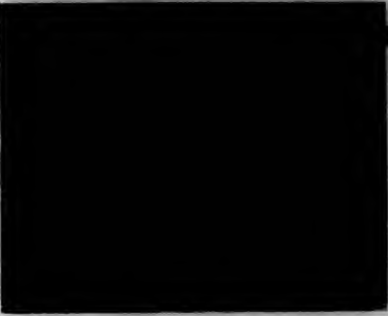
Savings can be anywhere from $25 to $300 per page using a CAP system. A company that produces 2,000 to 5,000 pages annually, as most companies do, can find the savings staggering.

Depending on the number of pages produced and the level of complexity, CAP systems in general provide a viable total solution to the problems of cost, productivity and time management associated with technical in-plant publishing — bringing it out of the Dark Ages.

Peuto is president of Viewtech, Inc., a company that manufactures computer-aided publishing systems, based in San Jose, Calif.

Turning Hard Facts Into Hard Copy

By Gary P. Laroff



Computer graphics has become a valuable corporate tool because the technology can display business information in a format that looks like graphics, not computer graphics. Hard-copy devices have played an important role in raising computer graphics to the level it now occupies in an organization.

Anyone planning to purchase a hard-copy device should do some legwork before signing on the dotted line. Potential purchasers should not only review performance variables but should also make an attempt to understand what current products are being offered. Those who take the trouble to do so will be able to secure the printer, plotter or film recorder best suited to their particular business graphics environment.

Five major variables — image quality, resolution, speed, equipment cost and cost per copy — are key ingredients in an evaluation of the major criteria and trade-offs that exist among color or high-resolution monochromatic hard-copy units.

• Image quality, although the Number One priority, is often very subjective. Some aspects of image quality are the ability of pie charts to come out round, regardless of the aspect ratio of the copy; line and edge definition; area-fill ability; and color accuracy.

Pen plotters and the more expensive film recorders generally provide excellent line quality. Raster-oriented devices plot with closely spaced dots and, if the dot size is small (high-resolution) and the dots can be overlapped to smoothen the raster stair step, these devices can offer a quality of line definition equal to or surpassing that of a standard desktop plotter. Devices with a minimum of 240 dot/in. do a superb job; these devices are frequently laser printers.

Area filling is necessary for bars, pies, shading between lines and shaded character fonts. Solid areas should be free of streaks and voids, and shaded areas should be uniform. Uniform filling is most important in business graphics where aesthetics are a major consideration. Color raster nonimpact printers such as thermal transfer and ink-jet plotters appear to have the advantage at uniform area fill on paper and transparencies.

Sometimes color accuracy is not so important as color purity, for example, for those who would be satisfied with an 8-pen plotter. Often, however, color accuracy is important for visual impact. Recent advances in ink-jet, thermal transfer and film recorder technologies allow more than 64 different colors through rasterizing techniques. Some devices support anywhere from 256 colors to as many as 4,096 colors, depending on the hardware or software rasterization algorithm. Near-photographic quality will soon be available on the new nonimpact printers because of ever-increasing resolution and color saturation.

• Resolution is the number of discernible line pairs per inch. Dot/in. and addressable dot/in. are terms that are more often published, especially for the raster technologies. However, they are not true measures of resolution. Dot/in. describes potential resolution. If the dots overlap, as they often do with electrostatic, ink-jet, thermal transfer and laser technologies, curves and lines will look smooth and not stair stepped. As a result, the visual appeal of the image will be increased. This appeal is not without cost, however, and will be counterbalanced by a loss of resolution. If the dots are wider than their spacing, closely-spaced line pairs will not be discernible.

Any decisions about business graphics image resolution have to be based on two pieces of information: who will view the pictures and what output or display medium will be used.

A low- to medium-resolution terminal with screen-resolution copy is sufficient for preparing and creating charts. An A-size (8½ in. by 11 in.), 8-color, 480 by 360 pixels (about 50 lines per in.) ink-jet plot provides a good quick look for working copy, but it is far from photographic quality.

For corrections and content review (a typical middle-management function) peer graphics take the form of slides, overhead transparencies or paper hard copies. Peer graphics work well with screen-resolution slides (512 or more lines) or almost any

	Impact		Non-Impact						
	Pen Plotter	Impact Printer	Electro-Photographic	Color Electrostatic	Thermal	Thermal Transfer	Ink-Jet	Laser	Camera Systems
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pure colors	up to 10	8	1	8 Versatec ECP-42	1	8	8	8 (Xerox 6500) 1 (others)	unlimited
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Speed (8½ in. by 11 in.)	3 to 10 min. or more	3 min. approx.	20 sec	1 min. approx. 8 min. (E-size)	20 sec	45 to 120	1 to 5 min.	.2 to 6 sec (B&W) 20 sec (color)	1 to 2 min. (Polaroid) hrs to days (processing)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Approximate equipment cost	$700 to $1,880	$4,490 to $11,300	$4,400 to $7,900	$98,000	$1,000 to $5,000	$4,500 to $5,000	$900 to $17,500	$30,000 (color) $22,000 to $380,000 (B&W)	$6,600 to $200,000

Figure 1. Hard-Copy Specifications Comparison

color copy page or transparency with over 100 dot/in.

For presentation to management and outside clients, presentation graphics generally requires higher resolution. Slides with 2,000-line resolution are usually sufficient, but the 4,000-line versions are noticeably crisper. Paper hard copy and backup in black-and-white from a 240 dot/in. laser printer, 100 dot/in. color Xerox Corp. 6500 CCP or computer-driven ink-jet or thermal transfer plotter are appropriate.

• Speed is specified by any number of misleading terms. In./sec and maximum acceleration (Gs) are useful for comparing pen plotters with each other, but not for comparing a pen plotter with any other technology. Line/min describes some impact and thermal printers. In./sec is not uncommon for some electrostatic printers. Char./sec is borderline useless, unless the graphics are being generated from the character X. These specifications may show up on data sheets, but they don't state how fast the charts will be finished.

The only truly important statement of speed is how long it takes from the time a user pushes the button until he receives the copy in hand. Whether one copy is timed in units of seconds, minutes and hours or by the production graphics view of pages per minute, the time it takes to get the copy is the time that really matters.

• Equipment cost should include the price of interfaces, rasterizers and driving software. Remember, when a hardware module is used to overcome the speed of the bottleneck of software rasterizing on the computer, the cost of the add-on modules to perform the local rasterization must be added to the device cost.

• Cost per copy is variable and should include the cost of all expendables — paper, pens, toner and film. Host software rasterization cost should also be added.

The wealth of devices available today is awesome, but buyers must consider their present and future needs in order to meet the final objective of a graphics system. Figure 1 rates each of the nine major technologies on image quality, number of pure colors supported, resolution, speed (time for an A-size copy), cost per copy (not including computer overhead) and approximate equipment cost.

Hard-copy devices available to the potential buyer of a graphics system fall generally into one of the following seven categories: pen plotters, impact printers, electrostatic printer plotters, thermal transfer plotters, ink-jet plotters, laser printers and other high-resolution black-and-white printers and film recorders.

Pen plotters have traditionally been used for hard-copy continuous lines rather than the dot structure produced by various raster print technologies.

Features that differentiate pen plotters are: pen speed (usually measured in in./sec), pen acceleration (usually measured in Gs), manner and time required to change pens in order to change color and start plotting again, reproducibility (accuracy) and continuous roll or sheet feed of paper and transparencies. Another variable, of course, is price. Six- and eight-pen plotters are available in the under-$2,000 range with an acceleration of 4 Gs and pen speeds in the 15 in./sec range.

Slightly more costly are the production workhorse plotters that run essentially unattended; they either advance roll paper or automatically feed sheet paper. Plotters such as Nicolet Zeta Corp.'s Zeta 8 and Hewlett-Packard Co.'s 7550A are priced at $5,950 and $3,900, respectively. Both are 8-pen plotters with acceleration from 4G to 6G and pen speeds in 20 to 30 in./sec range.

Impact printers are essentially line printers with either multiple ribbons or one multicolored ribbon that can address individual dots and permit the printing of graphics and not just lists of alphanumeric characters. The main advantage of the impact printer is its low cost per copy.

A number of color impact printers have been on the market for some time. IBM offers some of the most popular printers, including Model 3287 and its somewhat faster replacement, the 3268 Model 2C. The 3268 Model 2C is a 4-color wire matrix ribbon impact printer that can operate at a maximum of 340 char./sec and prints approximately 2.7 times faster than the 3287 at a comparable price of $8,900. Graphics plots are generated in about two minutes at a cost of approximately 15 cents each.

Electrostatic printer plotters have traditionally produced black-and-white copies with images produced electrostatically by electrodes placing charges on dielectric paper, which is then passed through a toner.

At present, the Versatec Co. Colorplotter Model ECP42 is the only color electrostatic plotter available. The ECP42 is a good performer, producing full-color copy with a high 200 dot/in. resolution over a large 34 in. by 44 in. page in only eight minutes at a cost of $1.44 per copy. This model costs $98,000.

Thermal transfer plotters, which compete with ink-jets as the two major innovative nonimpact technologies, are becoming more reliable and less expensive. Most use a low-melting-point wax transfer ink instead of liquid ink. On the surface, the products hold the promise of simplicity, reliability, quietness and low-cost hardware. Most of these devices are manufactured in Japan, and not all of them are available in single quantities to end users.

The Seiko Instruments U.S.A., Inc. Model CH-5201B, priced at $10,950, has a resolution of 150 dot/in. and makes copies at the rate of one each minute. The Gulton Industries, Inc. CP-80C has a resolution of 100 dot/in., takes 45 seconds for a copy and is priced around $4,950. Shinko Electric has two families of thermal transfer plotters. Toshiba Corp. has Model TN-5400, which produces 200 dot/in. A-size plots in a minute. Most of these models are supported by the Lasergraphics, Inc.'s UI-100 series of vector-to-raster converters.

Ink-jet plotters output high-quality color paper and transparency graphics. The major variables are resolution; the number of colors of ink from which all other colors are mixed (four colors are better than three); and convenience issues such as speed, single paper sheet handling and so on.

Ink-jet units using line-printer-like paper feed are available from Advanced Color Technology Co. and Printacolor Corp. Tektronix, Inc. has three units covering the full range of ink-jet capabilities with prices from $1,595 to $12,950. The high-resolution winner, with 203 dot/in., is the Benson-Varian, Inc. Colorscan 800, which makes A-size copies in 3.5 minutes but can also produce B-size plots (11 in. by 17 in.) and is priced around $17,500.

A large number of devices with varying prices and throughput rates fulfill the need for high-resolution black-and-white printers in production graphics as well as publication-quality graphics. At the lower price end are Quanex Management Systems, Inc.'s Lasergrafix series, Digital Equipment Corp.'s LN-01 and LN-03 and Xerox Corp.'s 2700. They are characterized by a speed in the range of five to 10 pages each minute. At the higher price end are the high-volume (100 to 300 pages per minute) laser printers such as Xerox 8700 and 9700 and IBM 3800. Also available are the computer output microfilm (COM) recorders from Information International, Inc., known as Models Comp 80 and Comp 80/3 and the IBM 4250 (600 dot/in.) electroerosion printer.

Most people use film recorders to produce slides, but some devices also produce other format films and some produce 8 in. by 10 in. Polaroid Corp. prints directly. There are three generic types of film recorders: terminal-driven film recorders, stand-alone film recorders and direct-drive film recorders.

Terminal-driven film recorders are independent of the computer and graphics software and are not discussed here. Stand-alone film recorders are intended for high-volume, photo-ready, high-accuracy output. Typical devices in this category are produced by companies such as Celco, Dicomed Corp., Genigraphics Corp. and Information International.

Direct-drive film recorders or slide composition systems are becoming quite popular and are available in even lower price ranges. Typical products include the Dicomed Dicomedia family and the Genigraphics 100C, 100D and 100V at the higher performance and price end. The newer desktop systems tend to cost from $1,500 to $25,000 without rasterizing equipment. Examples are Matrix Corp.'s QCR-D2000 (resolution 2,048 by 1,366) and QCR D4/2 (resolution 4,096 by 2,732); Polaroid Corp.'s Palette Mark II, which is supported as the Lasergraphics MPS-2000 (resolution 2,048 by 1,366); and California Computer Products, Inc.'s (Calcomp) Samurai, which produces anti-aliased slides with a resolution approximately 4,096 by 2,732. One of the more recent announcements is the self-contained Bell & Howell Co.'s Color Digital Imager IV film recorder, one of the lower cost offerings with a resolution of 832 by 630.

The end product of business graphics is usually a paper chart, overhead transparency or 35mm slide. Choosing the right hard-copy device is critical to getting the right output. There are a number of very fine color output devices available today, and a little effort at the time of purchase will pay dividends every time you make a hard copy.

Laroff is marketing manager for Integrated Software Systems Corp. (Issco) and author of the recently published book Choosing Hard Copy Devices for Visual Information Systems.

Products

PRINCETON, N.J. — **Executat, Inc.** has introduced a software package for the IBM Personal Computer or PC-compatible with at least 256K bytes random-access memory, two disk drives, a graphics card and a high-resolution graphics board.

The package, called Executat, integrates statistical and graphics procedures designed to make use of modern data analysis techniques. Execustat retails for $495.

For more information contact Execustat, Inc., Research Park, 2 Wall St., Princeton, N.J. 08540.

BOULDER, Colo. — **Precision Visuals, Inc.** has introduced a new software package that reportedly enables casual and experienced users to create presentation-quality graphics. Picsure, the new interactive package, is machine and device independent and supports the full hardware capability of more than 80 graphics output devices, according to the vendor.

Picsure is available immediately for IBM systems running under VM/CMS or MVS/TSO, for the Digital Equipment Corp. VAX with VMS and with Unix System V. A standard Ascii version is also offered. Picsure is priced from $6,500 to $25,000, depending on machine class.

For more information contact Precision Visuals, Inc., 6260 Lookout Road, Boulder, Colo. 80301.

IRVINE, Calif. — **Infographics, Inc.** recently announced Choice, a business color graphics package that incorporates the rudiments of artificial intelligence (AI). By incorporating certain AI elements into the package, the graph can be determined by the data.

Choice can accept data directly from many popular spreadsheet programs and runs on any computer with MS-DOS, PC-DOS, CP/M 80 or CP/M 86 operating systems, the vendor said. Choice requires no graphics board or color monitor; the graph cannot be viewed on the screen, but will output to any of seven plotters and 25 printers.

Choice retails for $395. Memory requirements are 64K bytes random-access memory (RAM) for 8-bit microcomputers and 128K bytes RAM for 16-bit microcomputers. Dual disk drives are also necessary.

For more information contact Infographics, Inc., 17961 Cowan St., Irvine, Calif. 92714.

MERRIMACK, N.H. — **Facit, Inc.** has introduced two-pen plotter systems designed to meet the requirements of Hewlett-Packard Co.'s Graphic Language, which has become a standard in graphics printing.

The 4550, priced at $795, accepts media in sizes up to 8½ in. by 11 in., and the 4551 accepts media sizes up to 11 in. by 17 in. Because of their HP GL emulation capability, the Facit 4550 and 4551 run a wide variety of software for business graphics and computer-aided design/computer-aided engineering applications, the vendor said.

Further information is available from Facit, 9 Executive Drive, Merrimack, N.H. 03054.

SANTA CLARA, Calif. — **Viewtech, Inc.** introduced its new Viewtech System, a third-generation computer-aided publishing system designed for corporate publications departments or in-plant users. The Viewtech System reportedly handles the publication process from copy to camera-ready art by allowing users to create, display and edit pages with both text and graphics in typeset form on screen.

The Viewtech System uses a 17-in. high-resolution screen monitor with detachable keyboard and three-button mouse. The system's software, written in C programming language, is comprised of over 160,000 lines of code. The cost of a six-workstation system is approximately $200,000, with each additional workstation costing in the $15,000 to $25,000 range.

For more information about the Viewtech System contact Viewtech, Inc., Suite 101, 2880 San Tomas Expressway, Santa Clara, Calif. 95051.

Calendar

April 16-19, Boston — **Network Management/Technical Control Conference and Exposition.** Contact: Network Management/Technical Control Conference and Exposition, Box 880, Framingham, Mass. 01701.

April 17-24, Hannover, W. Germany — **Hannover Fair.** Contact: Deutsche Messe-und Ausstellungs-AG, Abt. 311/RS, Messegelande, D-3000 Hannover 82, W. Germany.

April 23, New York — **Integrated Office Systems: User Needs and Vendor Responses.** Also, April 25, Chicago; and April 30, San Francisco. Contact: Arthur D. Little Decision Resources, 17 Acorn Park, Cambridge, Mass. 02140.

April 23-25, Chicago — **Understanding Modern PBX Systems.** Contact: Business Communications Review, 950 York Road, Hinsdale, Ill. 60521.

April 24-26, San Francisco — **Unix Systems Expo/85 Spring.** Contact: Computer Faire, Inc., 181 Wells Ave., Newton, Mass. 02159.

April 24-26, New Orleans — **Spring '85 Seminar.** Contact: American Production and Inventory Control Society, Inc., 500 W. Annandale Road, Falls Church, Va. 22046-4274.

April 24-26, Washington, D.C. — **Computer Graphics for Business.** Contact: Technology Transfer Institute, 741 Tenth St., Santa Monica, Calif. 90402.

April 25, New York — **Executive Briefing On Managing Information Resources for Competitive Advantage.** Contact: Research and Planning, Inc., 215 First St., Cambridge, Mass. 02142.

April 29-30, Chicago — **Local-Area Networks.** Contact: Business Communications Review, 950 York Road, Hinsdale, Ill. 60521.

April 29-May 2, Washington, D.C. — **Experts On Networks.** Contact: Technology Transfer Institute, 741 Tenth St., Santa Monica, Calif. 90402.

May 1, San Jose, Calif. — **AT&T, IBM and Unix: Desktop Directions.** Contact: Yates Ventures, Suite 201, 3350 W. Bayshore Road, Palo Alto, Calif. 94303.

May 6-8, Los Angeles — **Micro-Mainframe Strategies.** Contact: Technology Transfer Institute, 741 Tenth St., Santa Monica, Calif. 90402.

May 6-8, Boston — **Relational Data Base.** Also, May 13-15, Los Angeles. Contact: Technology Transfer Institute, 741 Tenth St., Santa Monica, Calif. 90402.

May 6-9, Atlanta — **Comdex/Spring.** Contact: The Interface Group, Inc., 300 First Ave., Needham, Mass. 02194.

May 8-10, San Francisco — **Local-Area Networks.** Contact: Technology Transfer Institute, 741 Tenth St., Santa Monica, Calif. 90402.

May 8-10, Washington, D.C. — **Advance '85 — The Information Age.** Contact: Advance '85, Women in Information Processing, Lock Box 39173, Washington, D.C. 20016.

May 14-15, New York — **Data Networks: New Solutions.** Contact: The Yankee Group, 89 Broad St., Boston, Mass. 02110.

May 20-22, Silver Spring, Md. — **1985 Trends and Applications Conference Utilizing Computer Graphics.** Contact: The Institute of Electrical and Electronics Engineering, Inc., P.O. Box 639, Silver Spring, Md. 20901.

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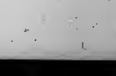

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